OCTOBER 1953

PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

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PERMANENT MOLD CASTINGS
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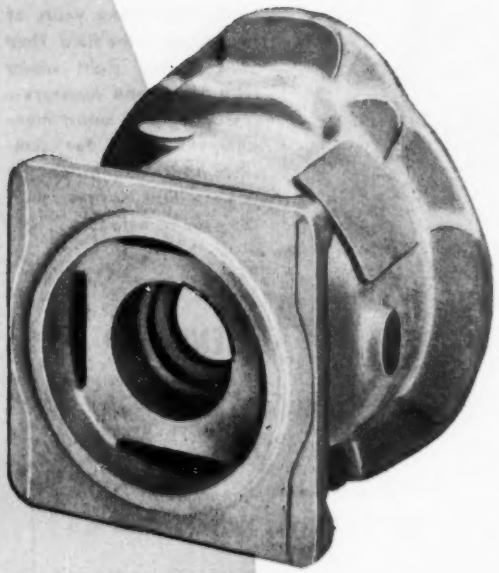

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OCTOBER 1953
Vol. 11 No. 10

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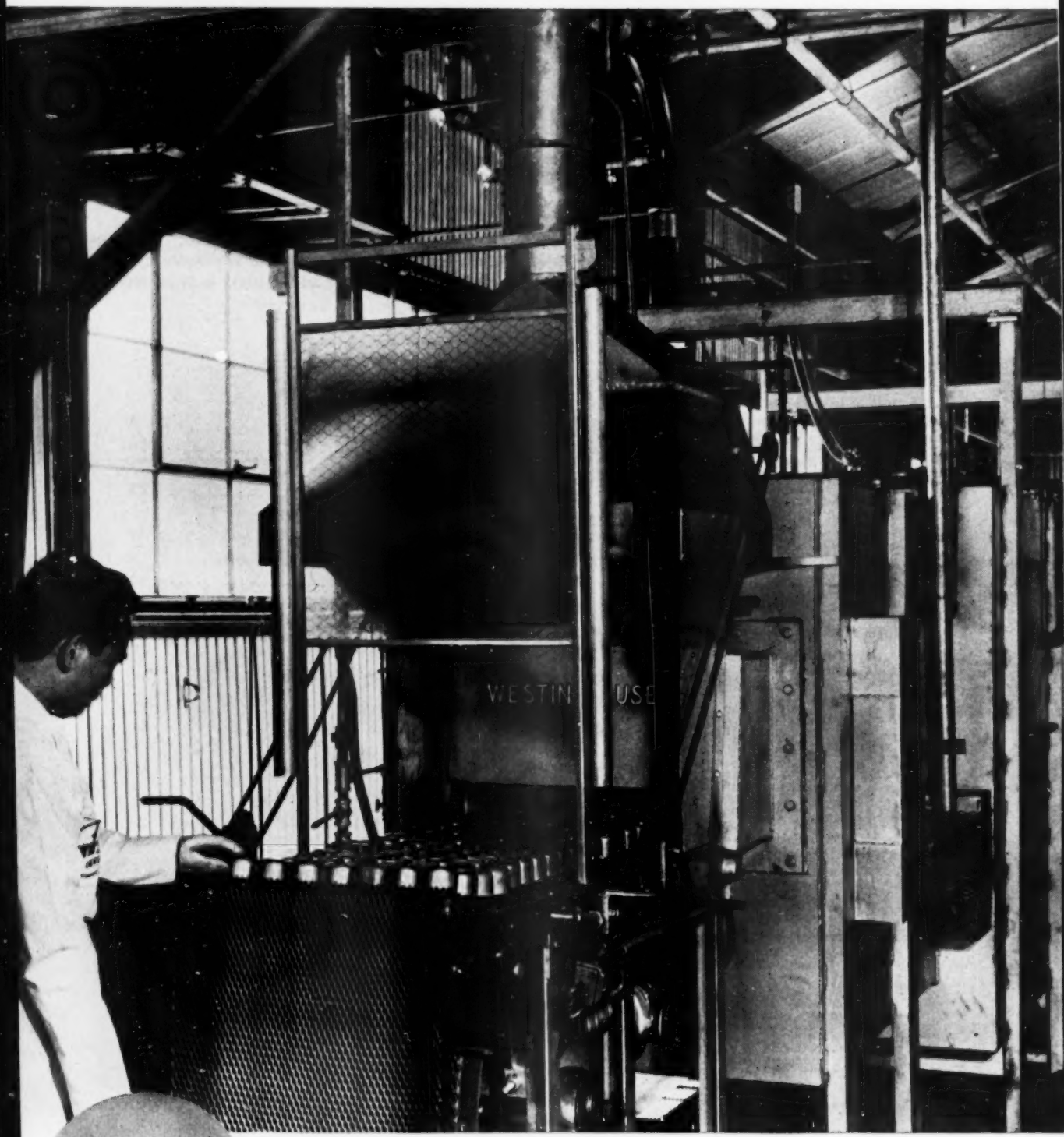


IF YOUR PRODUCT CALLS FOR HEAT-TREATING . . . IT CALLS FOR A WESTINGHOUSE FURNACE . . . *GAS OR ELECTRIC.*

You are invited to visit our Booth Number 1611 at the 35th annual Metal Exposition, held in the Public Auditorium, Cleveland, Ohio, Oct. 19 through the 23, 1953. We will be featuring our new Shaker Hearth Furnace.

"Production capacity increased 400% with Westinghouse Sintering Furnace"

. . . says Kwikset Locks, Inc.

As the largest producer of custom-molded powdered metal parts west of the Mississippi, Kwikset Locks, Inc., of Anaheim, California, has this to say about its Westinghouse Sintering Furnace:

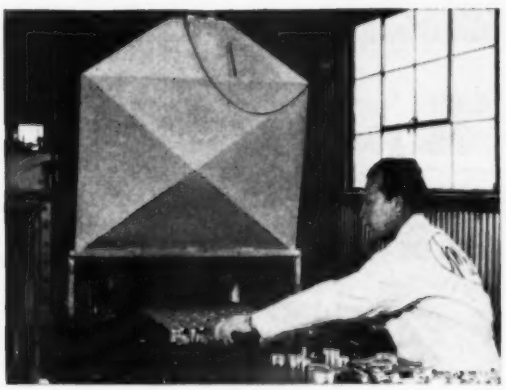
"We chose a Westinghouse Electric Belt Conveyor Furnace when desiring four times the production capacity formerly available. We now enjoy the desired protective atmosphere needed for top-quality control, gain excellent temperature control and response, and take advantage of fast Westinghouse engineering and repair service. We have found, through experience, that Westinghouse Furnaces are easy to operate.

"Our principal operation is sintering brass components for our residential and commercial lock sets. These parts were formerly machined from bar stock, precision cast or stamped. By converting to the sintering process with a Westinghouse Electric Belt Conveyor Furnace, we have eliminated scrap and machine finishing . . . thus increasing production and reducing costs."

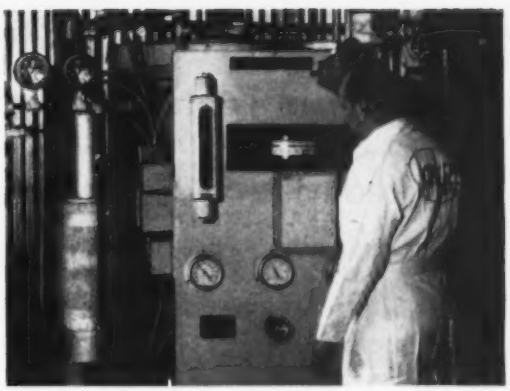
Why not investigate Westinghouse Heat-Treating Furnaces for your plant? A complete line covering every heat-treating job is available. Write for free book *Harnessing Heat* (B-5459). Westinghouse Electric Corporation, Industrial Heating Department, Meadville, Pa. J-10412

YOU CAN BE SURE... IF IT'S

Westinghouse



The above shows the "briquettes" after they have left the cooling chamber where they have been cooled below oxidizing temperature. If unusually close tolerances are not involved, the pieces are used as sintered.



Shown above is the Westinghouse Ammogas® Atmosphere Generator (1500 cfh, 1850° F. max.) that gives Kwikset Locks, Inc., the desired atmosphere for top-quality control.

You Don't Have To Add Skilled Manpower To Your Production Team

. . . to get die castings like these

Our engineering staff would welcome the opportunity to help you with your needs. Just drop us a line for prompt, practical assistance.

Here's basic die casting data for every engineer and designer. Write on your company letterhead for your copy.

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LETTERS TO THE EDITOR

LARGE INVESTMENT CASTINGS

We are interested in solving some production problems by use of investment castings, either lost wax or shell moulding or both. Will you please furnish a list of those who are producers of such castings near our plants. (Indiana and New Jersey).

We have several requirements, one of which is for castings up to 30" in diameter and weights up to 200 lbs.

Would you also recommend a good technical book for complete information on these processes. — R. R. (Superintendent).

We have sent names of investment and shell mold casters, but doubt that any of them can handle pieces as large as 200 pounds. By using frozen mercury patterns (Mercast process) somewhat larger castings can be produced than are generally possible using wax or plastic patterns. However, the largest size that has so far been produced successfully is about 40 pounds.

The limitation on shell mold castings lies in the size of shell making equipment now available. We have not seen any castings made by this process approaching 200 pounds, but there are so many new developments, and the field is growing so rapidly, that we hesitate to say it can't be done. — Ed.

PROTOTYPE ALUMINUM CASTINGS

Frequently we have need of prototype quantities of aluminum alloys castings for development work on instru-

continued on page 8

*FROZEN MERCURY INVESTMENT CASTING

MERCAST* Buttonholes

BUTTON A GENERATOR on or off of an airplane? Westinghouse does! And at a reported time saving of up to 8 man-hours per plane!

The ingenious new Westinghouse generator mounting bracket employs "buttonholes" that permit the assembly to be quickly slipped on or off over headed studs on the airframe. For practical production of this unit, a one-piece precision casting to close dimensional and surface tolerances is the economical answer. This casting, however, is much larger than can be produced by ordinary investment casting processes.

Westinghouse brought the problem to Alloy Precision Castings Company. Engineers and metallurgists at Alloy developed the illustrated 6 lb., 6½ inch diameter mercasting in 410 stainless. Critical tolerances are held to ±.003"/inch. Very little finish machining is required and the "buttonholes" are used as cast. Complete inspection by Alloy assures customers top quality and accuracy.

Mercasting made the Westinghouse generator mount idea a reality. Send details about your "impossible" or "too costly" jobs today! Learn how Alloy Precision can save you time and money with designs for mercasting.

A-6250

ALLOY PRECISION CASTINGS COMPANY, DEPT. C-6
45th and Hamilton, Cleveland 14, Ohio

Please RUSH Bulletin 706 describing the Mercasting Process.

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A Complete Die Design Service Available
Write for our Illustrated Brochure

PERMANENT MOLD DIE COMPANY, INC.

For additional information Circle No. 44 on the Reader Service Card

continued from page 6

ments. The characteristics in which we are most interested are thinness of section and relatively close tolerances. Up to the present, we have been specifying sand castings of alloy 356 T-6.

Could you furnish us a description of the plaster cast process and let us know if you recommend it for low-quantity experimental work.

We would also appreciate your suggestions concerning the names of any foundries that specialize in handling experimental orders. — E. B. S. (Section Head).

Two of the processes we cover editorially are used very commonly to produce prototype quantities for development purposes. Plaster mold casting and investment casting are capable of producing thin-walled, very accurate pieces in small quantities with relatively low tooling cost.

We have forwarded an article on the subject of prototype castings and also names of several foundries that have done this type of work successfully. Many die castings, nowadays, are produced experimentally as plaster mold or investment castings so that all design changes can be made and final details checked so that expensive changes in the die casting dies can be avoided. — Ed.

FINISHING SYSTEMS

We would appreciate receiving your articles "Clear Protective Coatings over Chromium Plate Systems" by George Lim Poy v. 10, November 1952, and "How to Select Compounds for Barrel Finishing Metal Parts" by Kurt G. O. Pinke, v. 11, April 1953, as listed in Metals Review. — E. A. H. (Product Engineer).

Copies forwarded. — Ed

A 650-TON SQUEEZE...

MAKES MOLTEN METALS BEHAVE!

POWERFUL TWO-STAGE INJECTION SYSTEM AND EXCLUSIVE NEW "HYDRA-LOCK" CLAMP are featured by the LEWIS die-forge casting machine. This machine brings new concepts of quality, economy and safety to the die casting industry. It is designed to mass produce, with minimum scrap, high-strength, low-cost aluminum and magnesium alloy parts weighing up to 9.5 pounds.

The high-speed hydraulic injection system fills the dies rapidly and then compresses the molten metal with final squeeze pressures up to 100,000 pounds. These tremendous pressures are possible because of the LEWIS "HYDRA-LOCK" mechanism, which exerts a 650-ton hydraulic clamping pressure to keep dies closed and prevent "spitting". Both injection speed and final squeeze pressure are variable to meet individual job requirements.

"HYDRA-LOCK" also permits quicker, easier die setting. Its design gives the moving die-plate a ball-and-socket action that compensates for misalignment of die faces within reasonably close limits.

For efficient . . . low cost . . . safe production of superior die castings, specify the LEWIS machine. It has no equal for quality or economy.

Write for BULLETIN No. 103 for details and specifications, or call BEdford 2-2500.

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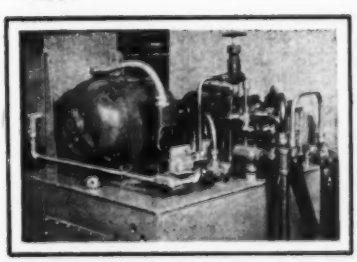

Hydraulic power unit is furnished as a separate component to permit remote installation in modern plant layouts

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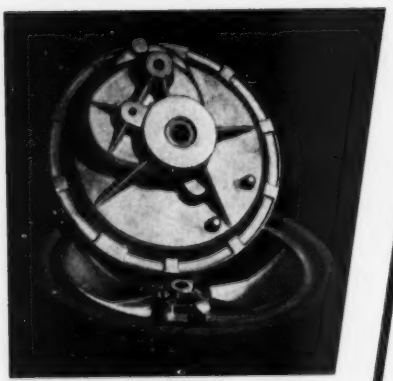
....depend on

ACME OF CHICAGO

A typical ACME casting for a defense product. Fin sections have a wall thickness of 3/16"



These two castings are machined and assembled as a gear case housing for a peace-time application.

For either defense or peace-time production ACME of Chicago offers a complete casting service including aluminum alloy permanent mold and semi-permanent mold castings and aluminum and magnesium sand castings.

Whether your requirements are for ten or hundreds of thousands of castings of a single design—we are interested in working with you.

We produce light metal castings weighing from a few ounces to hundreds of pounds.

Engineering knowledge and production experience can readily mean the difference between success and failure in using light metal castings.

Over 32 years of engineering and foundry experience are back of ACME service.

ACME of Chicago has a complete engineering service. We will consult with you during the design stages of your product. Consultation with experienced engineers at this stage of your planning may save you many headaches and dollars on production jobs.

Your inquiries and requests for information are always welcome.

ACME ALUMINUM FOUNDRY CO.

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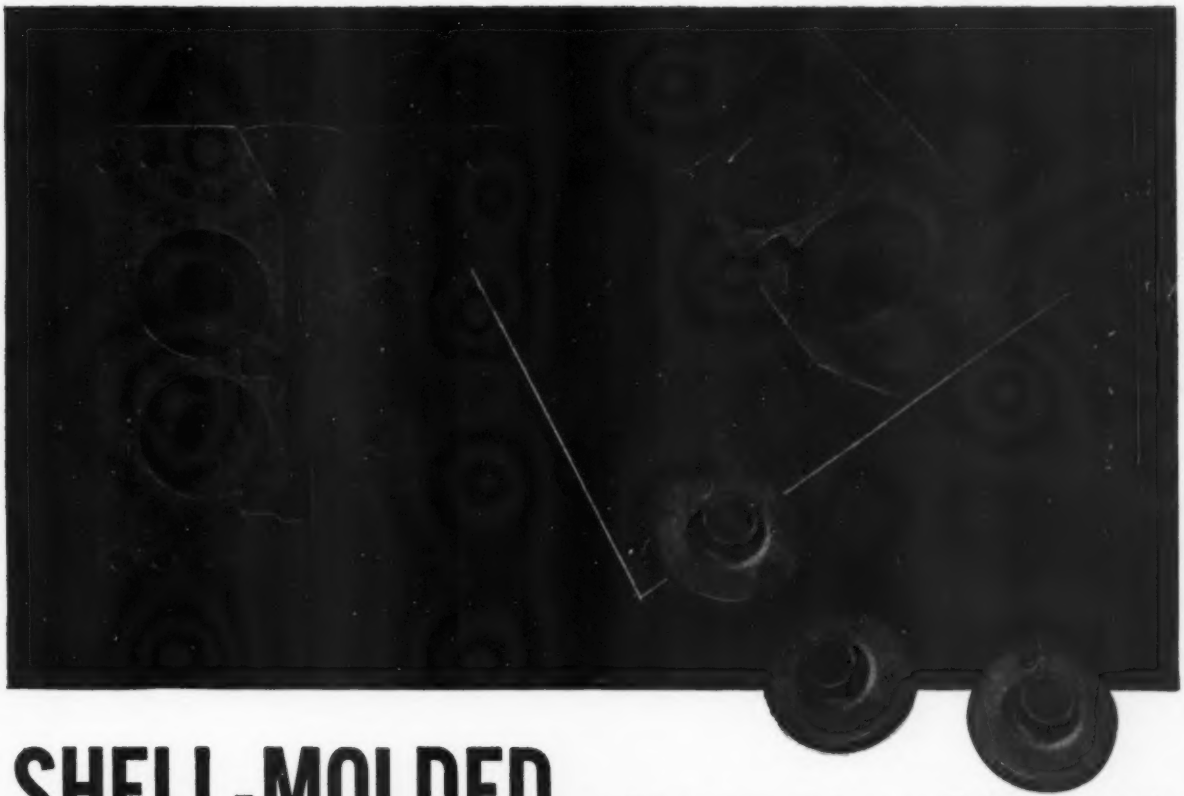

SHELL-MOLDED castings can cut your finishing costs

When your foundry delivers castings made by the shell molding process, you can expect notable savings in finishing costs. Here's why:

- **Shell-molded castings have almost pattern-smooth surfaces.**
- **Pieces are cast closer to finished dimensions—tolerances as close as .003 to .005 inches per inch.**
- **The higher percentage of sound, uniform castings cuts down on rejects.**
- **There is less machining of castings, reducing time and production costs.**

How does the shell molding process achieve these results? By using thin, lightweight shell molds made of fine-grained sands bonded with BAKELITE Phenolic Resins. These molds reproduce pattern surfaces in close detail, are suitable for both long and short-run production of complex shapes. Consult your foundryman now about applying the shell molding process to your needs.

YOUR FOUNDRY DEPARTMENT OR SUPPLIER will be interested in BAKELITE Resin BR-12011S for shell molding. This new resin provides molds offering these advantages:

- **They reach minimum usable strength faster in the curing operation than molds bonded with ordinary resins.**
- **They retain their strength for longer periods at curing temperatures.**
- **They permit greater leeway in curing time, the most critical period in mold-making.**
- **They resist the tendency to distort on ejection from the pattern plate, insuring better mating of mold halves.**
- **They are more dimensionally stable, and resist deformation during the pouring operation.**

ASK YOUR FOUNDRY TO WRITE BAKELITE COMPANY, DEPT. FE-60.

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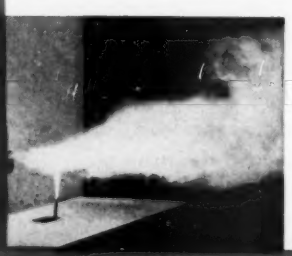
Losses Like this couldn't happen to Houghto-Safe users

Oil Leak Causes $100,000 Blaze in Local Plant

Fire caused by an oil leak destroyed most of the Holmesburg Manufacturing Company's plant last night in a blaze causing damage estimated at over $100,000. Flames raged for seven hours before firemen from five municipal fire companies had the fire under control. [illegible] was overcome by smoke and company employees nearly trapped by the blaze said they groped through the plant to escape the smoke that was rapidly filling the doomed building. One of the workers was rendered unconscious and had to be carried out by firemen. He is Henry F. Marburger, of [illegible] several men in the

5 years in the Lab
–now proved in the field!

CONVENTIONAL OIL BURNS INSTANTLY



An atomized jet of regular hydraulic oil pressure-sprayed into flame from a blow torch ignited immediately into an 8-foot blaze

New Hydraulic Fluid Won't Burn or Explode!

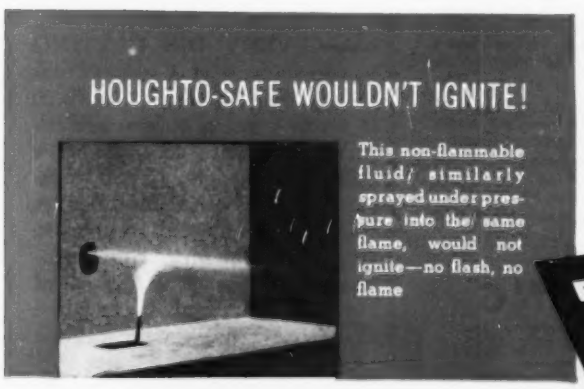
Houghton

HOUGHTO-SAFE

IS SAFE 7 WAYS!

Perfected after more than five years of research and field testing, Houghto-Safe offers protection to both men and machines. This new hydraulic fluid . . . rated "acceptable from the fire hazard standpoint" by Factory Mutual . . . now proves that fire-resistant qualities *can be obtained without loss in operating efficiency!* In plants performing die casting, welding, hot press forging and other hydraulic operations—especially near open flames or extreme heat—Houghto-Safe is the long-awaited answer. Here are 7 good reasons why it's really safe . . .

1. **It's Non-Flammable**—This newly-developed hydraulic fluid won't burn or flash—even when sprayed into an open flame.
2. **Prevents Corrosion**—The new formula contains inhibitors developed by Houghton to prevent corrosion and rust in any hydraulic system.
3. **It is Non-Toxic**—Safe for workers to handle—and it bears no unpleasant odor.
4. **Fortified Lubricity Saves Equipment**—Reinforced for high film strength by a chemical additive that gives metal parts greater protection for longer periods.
5. **Oxidation Stability Adds Extra Life**—Its exceptional resistance to oxidation assures longer service life—proved by over 5500 hours of testing in equipment in actual use.
6. **High Viscosity Index Reduces Wear**—New Houghto-Safe has a viscosity index of 150, showing its stability through widely fluctuating temperatures, and providing safe operation at all normal temperatures. It won't freeze—pumps easily at zero without preheating.
7. **Safe for Packings**—Has no ill effect on synthetic rubber packings—neither attacks them nor impairs their high efficiency throughout their effective life.


HOUGHTO-SAFE WOULDN'T IGNITE!
This non-flammable fluid, similarly sprayed under pressure into the same flame, would not ignite—no flash, no flame

Ask the Houghton Man for our new bulletin, containing research data, case histories and pictured proof of Houghto-Safe's efficiency. Or write to E. F. Houghton & Co., Philadelphia 33, Pa., for answers to any questions you may have about this new safe hydraulic fluid.

HOUGHTO-SAFE

. . . a product of

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Ready to give you on-the-job service . . .

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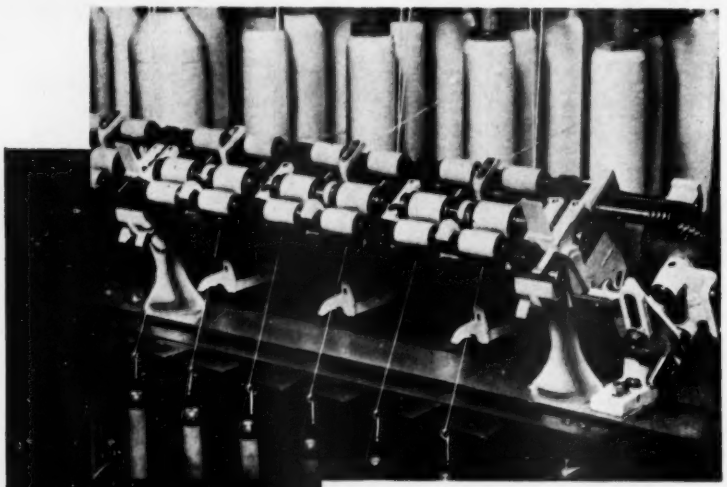
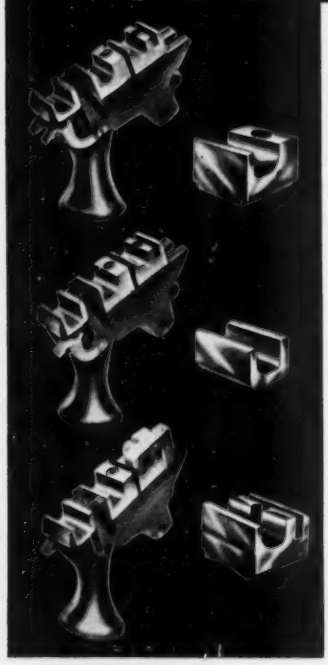
NO. 1 OF A SERIES

BECAUSE THEY WITHSTAND HEAVY TOP ROLL PRESSURE

SACO-LOWELL SHOPS USE *WAKEFIELD* ROLL STAND BEARINGS





Shaw Spinning, is one of the most effective long draft spinning assemblies in the world for cotton and short synthetics. After 10 years of experimentation, Saco-Lowell has found that fibre control required for long draft necessitated heavy roll pressure. This heavy pressure required a better, stronger, more rugged bearing. Saco-Lowell found that Wakefield bearings met and exceeded all their requirements.

For years, the Wakefield Bearing Corporation has produced all types of oilless and self lubricating bearings, bushings and machine parts. In addition, Wakefield holds an enviable reputation for quality and reliability in the production of all types of Special Textile Bearings and Parts including wood bearings, white wood turnings, swifts and swift parts and textile loom sheaves.

If you have a special problem our experienced research, development and engineering staffs are available for consultation without obligation. Our diversified and lengthy experience in the field makes Wakefield a name on which you can rely with utmost confidence to fill your requirements. Complete catalog information will be sent on request.

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BEARING CORP.

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In Canada: WAKEFIELD BEARINGS OF CANADA, Limited, 55 St. James St., West, Montreal, Can.

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Between the Lines

in this and future issues of PMM

— HEAT, accurately controlled and scientifically applied, is as characteristic of the processes reported in PMM as is the term "precision" which identifies the end products of these processes. This month, PMM offers technical reports on furnace uses.

— MELTING of small batches in the investment casting field has brought about the development of specialized furnaces and techniques which are reported on by consulting engineer, Sam Tour, beginning on page 62.

— SINTERING, which is used in the development of useful physical properties in powdered metal parts, is also reported upon by PMM Associate Editor Phil Kalischer. The first part, beginning on page 58, gives the theory and basic concepts of sintering this month. It will be followed in November with a paper on the actual methods and equipment used for sintering.

— EVERY DIE CASTING has flash on it as it comes from the die. Removal of this flash is a universal problem, accomplished by trim dies, abrasive belts, hand tools, barrel tumbling among other methods. A relatively new approach to flash removal on a rapid production-line basis is the use of abrasive blasting, as described in a case study beginning on page 67.

continued on page 18

Simple As A B C

To Solve Your Die Casting Problems Fort Offers You Quality Die Castings

from

Aluminum to Lead to Zinc

Specialists at Fort are always ready to help you take the guesswork out of your die casting problems. They are backed up in every detail by a complete, skilled organization in an up-to-the-minute plant with 100,000 square feet of productive space and capacity.

You save on costs directly because Fort designs and makes new labor-saving jigs and fixtures for its unusually complete Machining Department. In addition to large batteries of presses and other machining equipment for reducing finishing time, special purpose machines are designed and built to effect maximum economies.

Fort's large batteries of Zinc Die Casting Machines meet every size requirement. Effective capacity is also maintained for die casting aluminum and lead. In every case, expert metallurgical control is assured for proper choice of alloys.

Fort's modern tool and die making facilities are sufficient to completely tool up for your program and make the dies to conform with your specifications with the highest possible degree of accuracy. Quality is assured in finishing processes such as chemical coatings, plating and painting.

Fort guards its reputation and your product from the very start —engineering good casting design—carefully studying the best types of alloys to be used, expertly deciding on methods that will produce the best low-cost die castings, minimizing machining and finishing—ending with output on a speedy, accurate and economical basis.

No policy at Fort is more important than complete co-operation with the customer.

Guard Your Costs! Fortify with Fort!

Cut Costs — Reduce Machining and Finishing Time

FORT DIE CASTING CORP.

MARYSVILLE, MICHIGAN

For additional information Circle No. 17 on the Reader Service Card

An investment casting made of
BERYLCO BERYLLIUM COPPER

The work of this beryllium copper push pawl, part of a business machine time recorder, was once done by an assembly of two stampings and a separator. It lacked the necessary strength and rigidity, loosened in operation. Users complained; repair costs were high. Now, however, its one-piece simplicity assures foolproof operation. Its hardness assures long wear. And because of its added castability, the designer reduced costs 25 percent by selecting Berylco over any other high strength material.

Investment casting often has many advantages over sand casting or machining in the production of small, intricate parts. Berylco beryllium copper offers many cost-saving opportunities as an investment casting material.

Because of its fluidity and low pouring temperature, Berylco is easily and inexpensively handled. In addition to its high strength and hardness (175,000 psi through simple, low-temperature heat treatment), it is an excellent conductor, is noncorrosive, nonmagnetic, highly resistant to wear and embrittlement. Often, in fact, it is Berylco's unique combination of desirable properties that makes designers specify it for precision parts.

Increased advertising and greater experience are making more and more designers aware of the advantages of Berylco beryllium copper. Why not plan now to increase your range of alloys? Berylco is available in 5 lb., 2½ lb. and 3 oz. ingots. Send your trial order in today.

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BETWEEN THE LINES
continued from page 16

— HIGH DENSITY in powdered metal parts has been a bone of contention for some time. On page 50 is a report on some high density parts now in production.

— WHERE are investment castings used? There seems to be no limit to the products that can make use of investment cast parts. A few of these that will be reported in this and the next several issues of PMM include: aircraft instruments, parcel lockers, surgical apparatus, laboratory instruments, power tools.

— STAINLESS STEEL valve housing is used as an example to illustrate the process and advantages of shell molding, in a feature article starting on page 44.

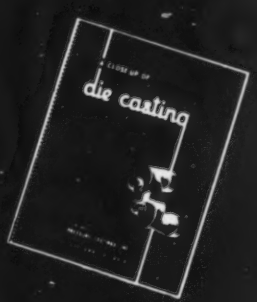
— TELEVISION reached the proportions of a mass production industry faster, perhaps, than any other in the current American industrial picture. It is no surprise that TV, like the automotive, kitchen appliance, business machine and other mass production leaders, has found die castings most economical. One of the many examples of this is pointed out on page 57.

— FIRST REPORT on what may be a major field of expansion for the use of iron powder will be presented this fall by PMM. Full details of current German use of powder metallurgy to produce automotive piston rings, with performance data, are now being compiled into a report you won't want to miss.

PCI

If there are die castings in your present planning you'll find Pressure a complete and dependable source with which to do business...!

This booklet brings our organization to you, in words and pictures. Write for your copy today!



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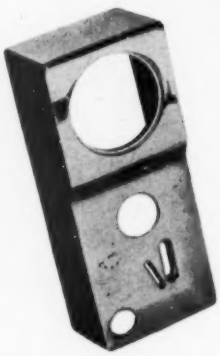
BRASS and BRONZE

PERMANENT MOLD CASTINGS

up to 15 pounds



Gravity die castings weighing just a few ounces or as much as 15 pounds are a specialty of Pressco Casting & Mfg. Corp. A wide range of brass and bronze alloys to meet your requirements can be provided.

Here are a few of the advantages of Pressco brass and bronze gravity die castings:

- Elimination of sand and other inclusions which, in turn, reduces scrap loss.
- Accurate and smooth surfaces to set up from, rather than having to machine them.
- Relatively close tolerances eliminate or reduce machining, reduces amount of finish stock to be removed, and thereby, permits cheaper machining methods and longer tool life.
- Steel inserts can be cast in place.
- Higher physical properties than possible with sand castings can be obtained, using same alloys, due to rapid chill from steel molds.
- Use of sand cores in steel dies permits complex interior while maintaining smooth exterior.

PRESSCO

Send for our free technical brochure giving design limits and alloy specifications.

PHONE: CHESTERTON 9224

CASTING & MFG. CORP.

CHESTERTON, INDIANA

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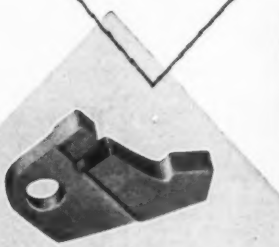
our service to industry grows with experience

METAL POWDER PARTS BY MORAINE



Thirty-two years and several billion parts ago we began learning about powder metallurgy. Our knowledge of this business is now considerable, yet even today there's no end in sight to what can still be learned.

Applying our always-growing knowledge enables us to find new ways to improve the physical properties of our metal powder products; to offer an ever-broadening range of materials to our customers; to make possible more and more applications.

Our position in the field of powder metallurgy is a proud one . . . but we take a greater pride in the fact that our products are providing industry with a means of improving performance while cutting costs.

moraine products

DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

Fire-resistant PYDRAUL cuts hydraulic fluid hazards

Hydraulically operated machines, like the die-caster in the picture, are often prey to vicious fires that start with a leak in a pressure line. Flammable hydraulic fluid escapes and sprays onto hot metal, turning to liquid flame that can burn or maim personnel, destroy stock and buildings.

Monsanto now provides a simple, effective answer to this problem which has cost American industry millions of dollars a year. Safe, economical Pydraul, a nonflammable-type fluid, is currently employed in more than 100 plant applications—with notable success.

Pydraul, when test-poured on molten metal and sprayed into an oxyacetylene flame, does not flash or ignite. It has high lubricity and is noncorrosive to metal . . . nonvolatile and insoluble in water. Because it requires no special changes in equipment, Pydraul can be introduced into a hydraulic system simply by draining and refilling. *Pydraul: Reg. U. S. Pat. Off.*

NO PYDRAUL HERE	PYDRAUL USED HERE
CASE No. 1 In a Southern steel tinning plant, a break in a hydraulic line released flammable spray that ignited oil. Fire loss: $925,000.	**CASE No. 3** When a hydraulic line parted, the fluid (Pydraul) sprayed into a hot zinc melting pot, splattered several employees. Result: no fire, no injuries, no production loss.
CASE No. 2 In a die-casting plant, rupture of a hydraulic line sprayed fluid over hot machines and gas-fired aluminum melting furnace. Loss: $340,000.	**CASE No. 4** On a new die-casting machine, a hydraulic leak caused by faulty union sprayed Pydraul over equipment and molten aluminum. Result: No fire, no damage.
Write today for "Pydraul F-9," an engineering report. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.	MONSANTO CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

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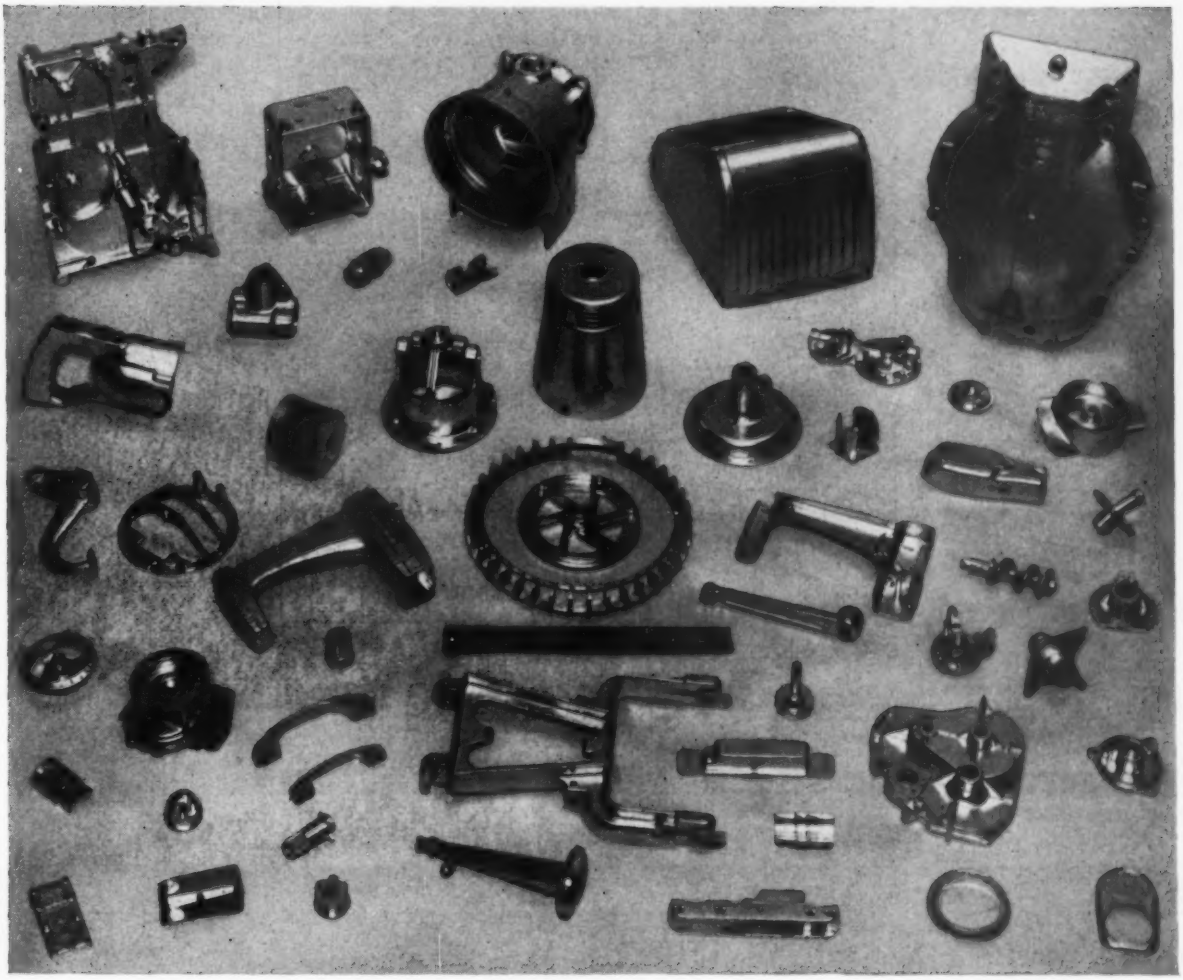
LOW COST PARTS



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• 1000 per lb. to 3 per lb. Specialized high speed, automatic equipment. Make two or more parts as one . . . reduce machining operations . . . cut piece costs. Write for Small Parts Bulletin and samples.

Leading manufacturers depend on Dollin for parts of all shapes and sizes. They know that Dollin has the experience and the facilities to capitalize on *all* the cost cutting advantages of the die-casting process. Equipment includes large cold chamber type, high pressure machines for aluminum castings . . . large plunger type machines for large zinc castings . . . automatic machines for small zinc castings (see left). Much of this equipment was designed by Dollin engineers. Send prints or samples for estimates. Engineering advice at no obligation. General Facilities Bulletin on request.

Dollin Corporation, 614 So. 21st St., Irvington, N. J.

DOLLIN Zinc and Aluminum **DIE-CASTINGS**

Sales Offices: Boston • Buffalo • Canton • Chicago • Detroit • Philadelphia • Pittsburgh • St. Louis • St. Paul

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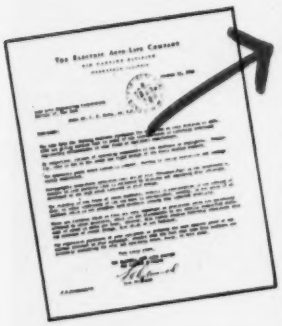
DIE CASTERS

Here's an *important* message for you from

THE ELECTRIC AUTO-LITE COMPANY

read it for yourself...



Gentlemen:

The Lake Erie Die Casting Machines purchased for operation at this division of AUTO-LITE are giving service that is proof of the incorporation of carefully developed engineering advancements in this field of equipment manufacture.

By comparison, failure of operating components of the machines is negligible. Primarily, this is due to the sound and rigid design of the basic machine members.

The hydraulic panel board system is compact, valving is easily accessible and leakage easily controlled.

Radiographic inspection indicates that use of your "Pressure-Pac" in the construction, results in less porosity than is evidenced by machines not employing this principle, developed to the high point achieved in your design.

The rigidity of your frame of these machines, results in acceleration of the setting of dies, as equal tensioning of the tie bars is accomplished, usually, in one cycle of adjustment which is not possible upon machines lacking this inherent stability.

These are features which we feel are very important as production rates are materially affected by these qualities, which are not discernible in the usually simplified statement of speed in shots per hour...

Our repetitive purchases of your equipment is probably the most sincere proof of our current interest in your equipment, coupled with the fact that Lake Erie machines are presently accounting for over 300 operating hours, daily in this plant.

F. H. Drummond
Vice-President

Carefully developed Engineering advancements

Sound, rigid design

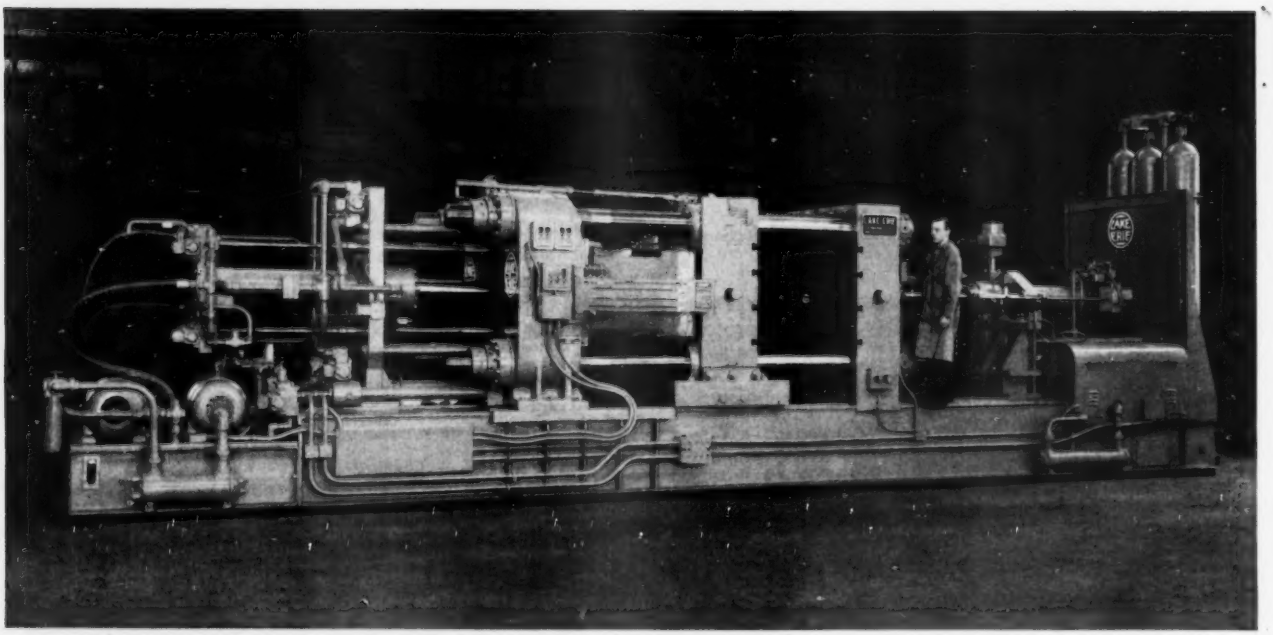
Less porosity with "Pressure-Pac"

Dies set in one cycle

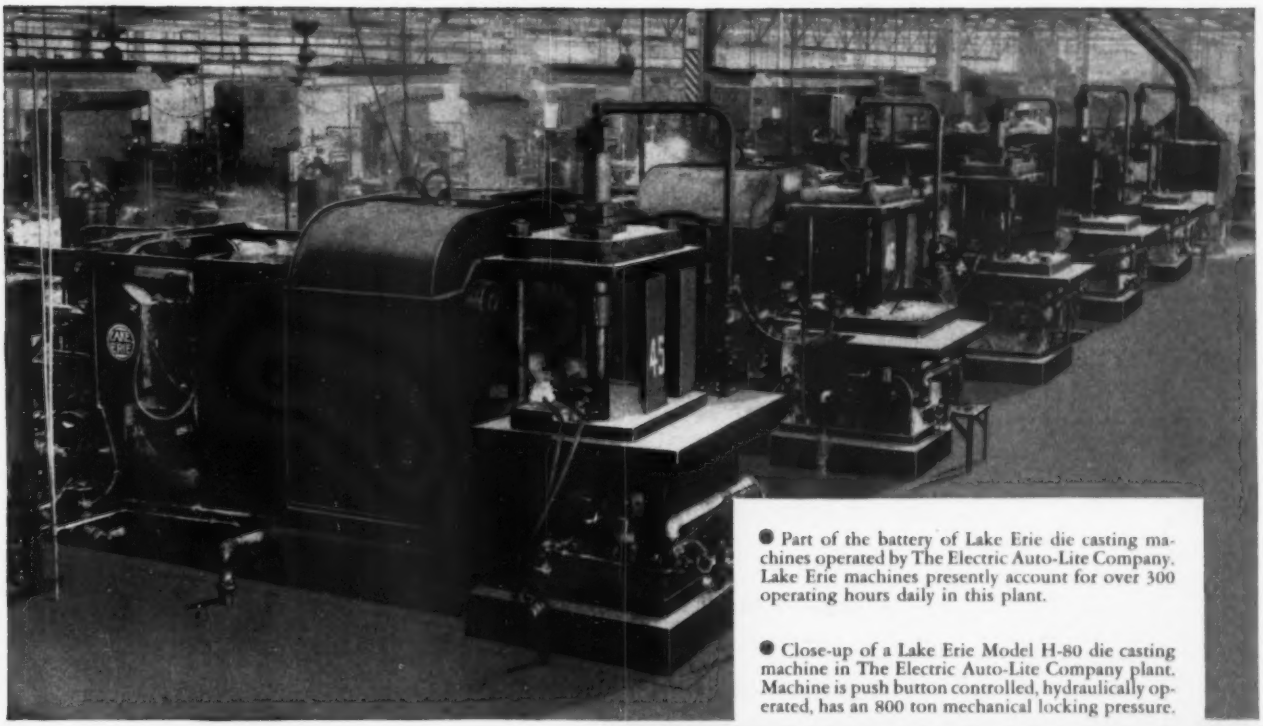
Production rates materially affected

REPETITIVE PURCHASES PROOF OF EQUIPMENT

...evidence that Lake Erie machines can improve your die casting operations



● Lake Erie Die Casting Machines are available in 10 models, ranging in capacity from 100 to 1000 tons for casting all the usual non-ferrous metals and alloys. Illustrated is new 1000 ton model.



● Part of the battery of Lake Erie die casting machines operated by The Electric Auto-Lite Company. Lake Erie machines presently account for over 300 operating hours daily in this plant.

● Close-up of a Lake Erie Model H-80 die casting machine in The Electric Auto-Lite Company plant. Machine is push button controlled, hydraulically operated, has an 800 ton mechanical locking pressure.

THE LAKE ERIE DIE CASTING MACHINES referred to by The Electric Auto-Lite Company have features long desired but never before available in die casting equipment. In addition to the patented "Wedge Cam Toggle" and "Pressure-Pac" injection unit, they have many other mechanical improvements that put this equipment strictly in a class by itself. These advantages are not restricted in use to The Electric Auto-Lite Company. Other Lake Erie customers are enjoying them and you can too. Write or call us today to discuss improved equipment for your plant.

Write for this Catalog

Illustrations, specifications, application data—all are here in complete detail with full explanation of the patented "Wedge Cam Toggle" and "Pressure-Pac" production advantages.

AMONG COMPANIES PURCHASING THIS EQUIPMENT SINCE ITS INTRODUCTION IN 1952

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General Electric Co.
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ROLLING MILL AUXILIARY EQUIPMENT

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Permanent METAL FILTERS

Oilite PERMANENT FILTERS Provide:

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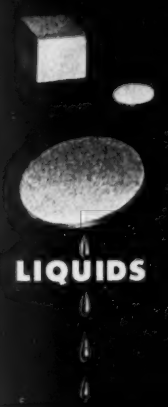
- Broad Range of Permeability, or Pore Size
- Effective Dampening, Diffusing, Regulating, Separating, Flame Arresting, and Metering
- Made of the Metal the Job requires
- Small, Medium and Large Sizes, too
- Low Part Cost



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FIELD ENGINEERS, DEPOTS AND DEALERS THROUGHOUT UNITED STATES AND CANADA

Oilite Products Include: Bearings, Finished Machine Parts, Cored and Solid Bars, Permanent Filters and Special Units

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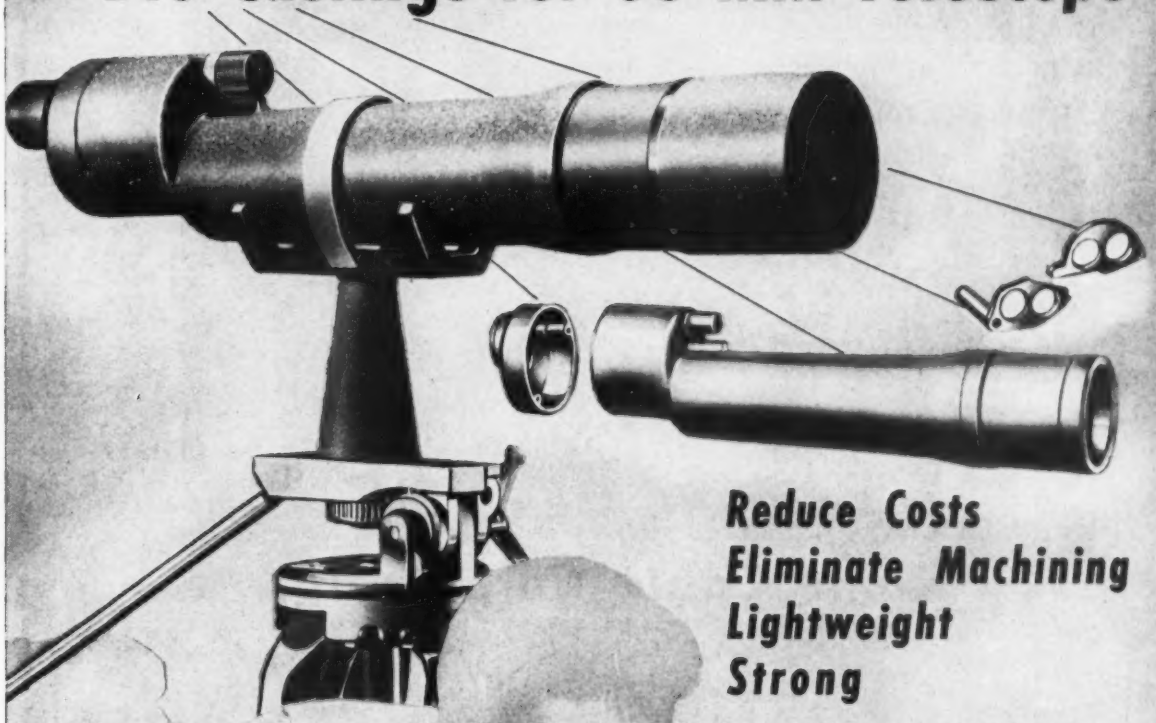
BAUSCH & LOMB selects PARKER Die Castings for 60 MM Telescope



Reduce Costs
Eliminate Machining
Lightweight
Strong

Bausch & Lomb, now celebrating its 100th anniversary, selects Parker as source for quality die castings. The product illustrated is the Bausch & Lomb BALscope Sr. 60 MM spotting scope in wide use as a shooter's spotting scope or, when mounted on a tripod, a telescope for astronomy, sports or bird watching. Parker Die Castings, component parts of this high precision scope, serve to reduce costs by elimination of machining operations. The parts are produced to rigid specifications . . . lightweight and strong.

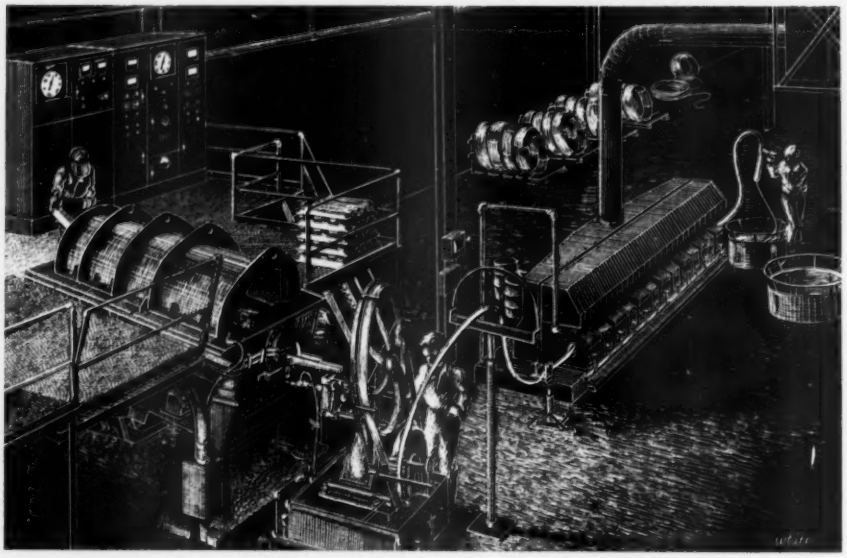
Consult with Parker on your next die casting requirements. Your action will be mutually profitable.

and when you think of Die Castings THINK OF

Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER ALUMINUM *and* ZINC *Die Castings*

From Molten Aluminum to 3/8" Diameter Rod in 1 1/2 Minutes!



Rome Cable Corporation

uses **AJAX INDUCTION FURNACES** **for**

MELTING ALUMINUM FOR CONTINUOUS CASTING AND ROLLING OF HIGH CONDUCTIVITY ROD

The picture above, a drawing made at the Rome Cable Corporation, Rome, N. Y., shows one of the most modern installations in the country for the continuous casting of aluminum rod directly from molten metal. From left to right are shown the electric controls of the adjacent 450kW. AJAX low frequency induction combined melting and holding furnace which is pouring molten metal into the Properzi continuous casting machine in the foreground, and the rolling mill from which the coiled rod is emerging.

This installation casts at the rate of about one ton per hour. The furnace feeds a continuous stream of molten aluminum at automatically controlled temperature into a rim cavity on the slowly revolving wheel of the Properzi machine. Metal loss from pig to rod averages less than 1 pct. Mechanical properties and electrical conductivity are excellent; the material is sound and fine grained. The men work under cooler, cleaner conditions because the only heat generated is within the melt itself. Due to melting conditions inherent in AJAX furnaces, the operation is continuous and no fluxing is required.

VISIT THE AJAX BOOTH, NO. 221, AT THE METAL SHOW

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AJAX ELECTRO METALLURGICAL CORP., and Associated Companies
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SCHULTZ

Specialists in Zinc Die Casting

● These intricate zinc die castings produced by Schultz represent the combined efforts of a team of skilled specialists. Product features: dimensional accuracy, stability, non-porous structure, flawless finish and low cost. No piece leaves our plant until it has passed a rigid inspection — unusual in its extensiveness even in the highly critical standards of our industry. Our facilities for inspection, assembly and packing are designed on a production line basis to produce a continuous flow of finished castings for prompt delivery.

Nearing a Quarter of a Century of Service—Exclusively Zinc Die Castings

SCHULTZ DIE CASTING COMPANY

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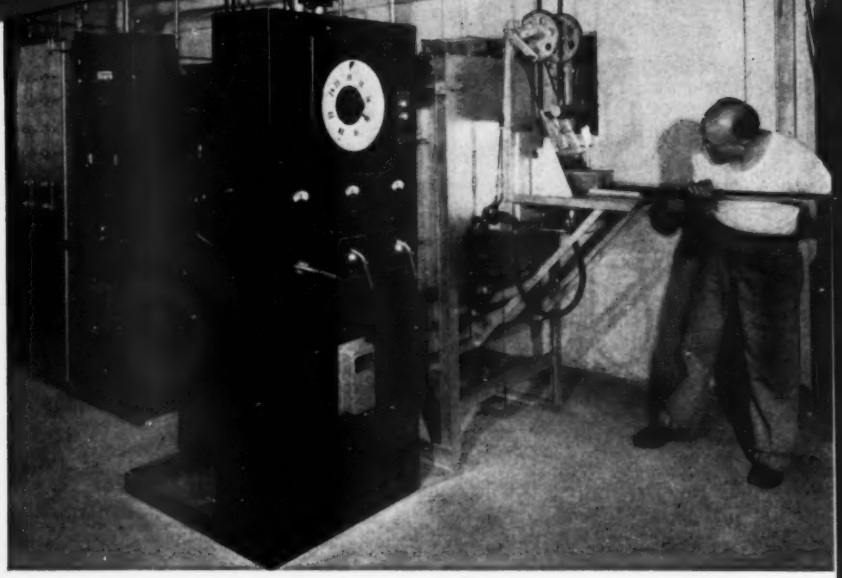
After 2 years development
C. I. Hayes announces

"AMPRO"

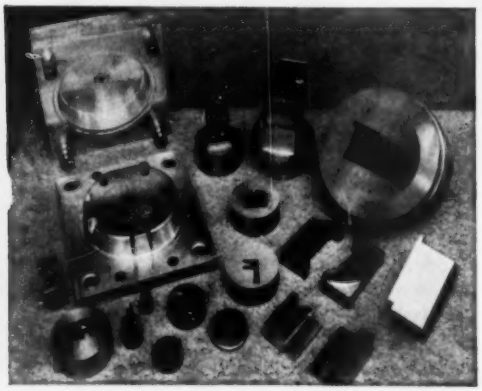
Bright Hardening in Dissoc



In actual use more than one year at

Staats & Staats, INC.
Pitcairn, Pennsylvania

This Hayes "Certain Curtain" Pusher Type Furnace, designed for bright heat treatment of High Speed and other tool steels, has been in continuous operation on bright heat treating and copper brazing of high carbon high chrome work at Staats & Staats for over a year.



on work like this

With the bulk of their work on vital defense contracts, Staats & Staats has the twin problems of urgency and quality — their segmented dies and special tools have to come through on tight schedules, always dependably hardened and free of decarburization, and with bright, clean surface.

CLYDE C. STAATS, PRESIDENT, SAYS —

with results like this

(1) Our Hayes Ampro Atmosphere Furnace is used to bright harden and copper braze intricate die parts.

(2) Complete elimination of oxidation or discoloration on parts being heat-treated.

(3) Reduces dimensional change of materials due to elimination of oxidation. A closer tolerance held.

(4) Cuts valuable bench and polishing time on intricate dies with the savings as high as 20%.

(5) Reduces cost of manufacturing form dies as much as 50% by form grinding dies in various segments and copper brazing with the atmosphere control.

C. I. HAYES INC. 72 BAKER ST., PROVIDENCE, R. I.
Manufacturers of Electric Furnaces Since 1905

...iated Ammonia Atmospheres

WITH PROPANE INJECTION

(Hayes patented-applied-for "AMPRO" process)

Now available to you on the basis of PROVEN RESULTS IN ACTUAL OPERATION!

Unique Hayes "Ampro" Process of Dissociated Ammonia with Propane Injection gives completely clean truly BRIGHT heat treatment.

Minimum volume of protective atmosphere requirements cuts down cost of operation.

BA Type furnaces range in temperature up to 2400°F for both High Speed and High Carbon High Chrome steels.

Furnaces are readily adaptable for drawing operations when required.

Hayes know-how and the conservative Hayes policy protect you! This equipment now has been TRIED AND PROVEN and is a KNOWN QUANTITY you can buy with confidence.

UNIQUE HAYES RECTANGULAR AMMONIA DISSOCIATOR – *see how easy it is to replace heating elements*

Just remove those port plates and the elements are accessible for servicing without dismantling. Equally easy to replace retort. Uses either liquid or vapor ammonia, producing 75% Hydrogen 25% Nitrogen. Complete controls. Capacities 100 CFH and up. Saves about 80% of the cost of bottle Hydrogen. Propane Injector mechanism is simple, positive, adjustable.

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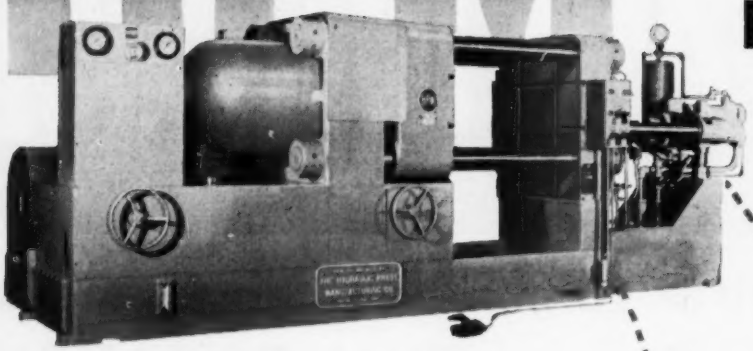
HPM

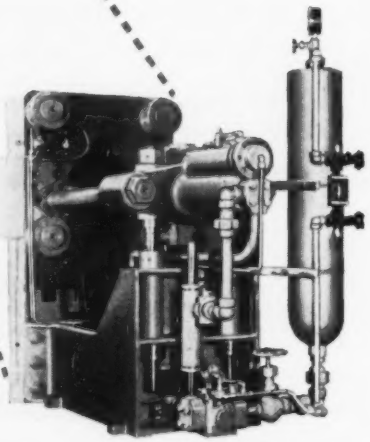


Model 400-B *Aluminum* Die Caster!

with Built-In Nitrogen Accumulator for INCREASED INJECTION SPEED!

for ALL-HYDRAULIC HIGH PRODUCTION of PRECISION PARTS . . .

- Here's a new, high-speed die casting machine for making aluminum castings up to 12 lbs. in weight. Listed below are just a few of the H-P-M design features which make this new die caster second to none:
- High-speed plunger advance . . . up to 400 ft. per minute.
- Positive, injection pressure build-up . . . no pre-fill valve to close.
- Built-in hydraulic ejector saves time, greatly reduces die costs and minimizes operator fatigue.
- Rugged straight-line "All-Hydraulic" die clamp with few moving parts, assure positive die alignment . . . die change-over is simple and fast.
- Dual hydro-electric safety devices guard against premature injection.
- Plenty of space around die mounting surfaces for installation of core pull cylinders.
- Independent handwheel adjustments for both die clamp and injection pressures.



400 ft. per Minute *Injection Speed*

Write for catalog 5106-A, today.

SPECIFICATIONS MODEL 400-B					
SIZE OF DIE PLATES	SPACE BETWEEN BARS	DIE OPENS	MAXIMUM DIE SPACE	CAPACITY PER SHOT (LBS.)	NET WT. (LBS.)
38"x38"	23"x23"	16"	42"	2.2 To 12.2 (Al)*	40,500

*Note: The model 400-B handles brass and magnesium die casting as well. Complete specifications on this and model 150-A (150-Ton) machines on request.

HPM **THE HYDRAULIC PRESS MFG. CO.**

1094 Marion Road, Mount Gilead, Ohio, U. S. A.

Presses For Every Pressure Processing Application

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Die
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NEW ENGLAND DIE CASTING COMPANY

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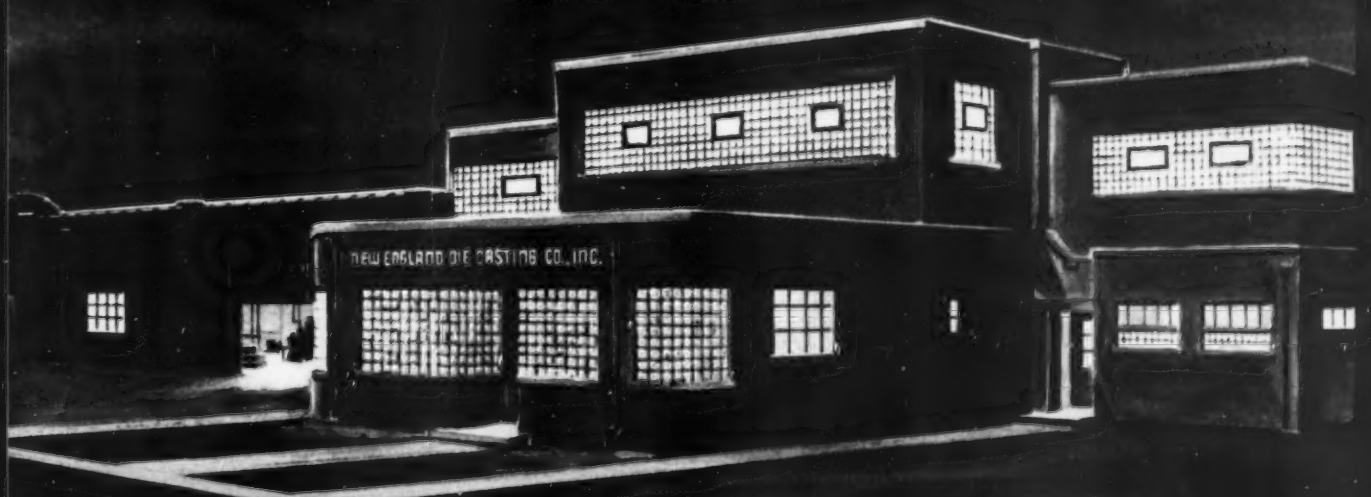
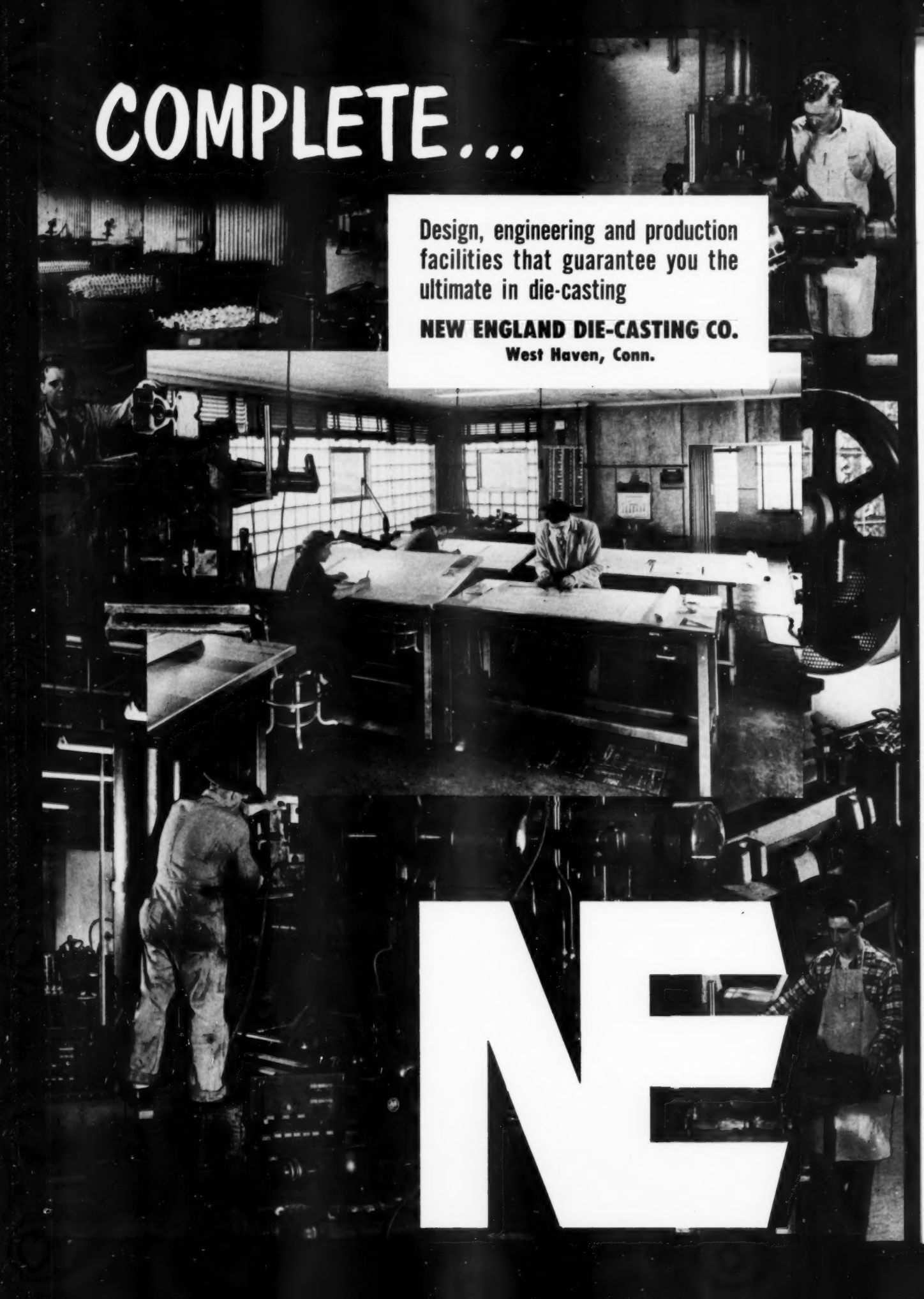
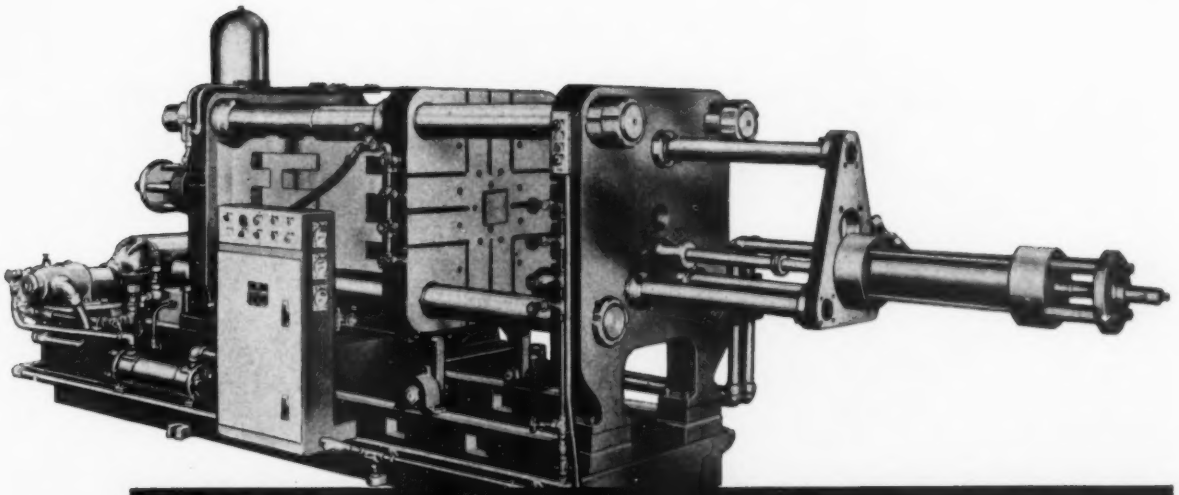


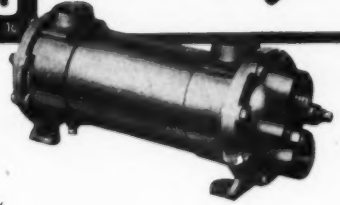
60000 SQUARE FEET OF COMPLETE, MODERN FACILITIES


COMPLETE...
Design, engineering and production facilities that guarantee you the ultimate in die-casting
NEW ENGLAND DIE-CASTING CO.
West Haven, Conn.
NE



Ross Exchangers for oil cooling

ROSS Exchangers



Designed to apply a locking pressure of 500 tons in producing aluminum castings up to 10½ lbs. per shot, this Model B 20-A Cast-Master incorporates many outstanding basic features. Among them: a Ross Type BCF Exchanger.

Hydraulic oil supplied by the 130-gal. reservoir is thereby kept from overheating and thinning. Capacity-robbing pump slippage is prevented!

"Ross Exchangers are doing their job so well that we accept them as one of the family", states Cast-Master, Inc.

Vouching for the rugged dependability of Ross Type BCF Exchangers are numerous other leading manufacturers of varied types of hydraulic machinery. They, too, have adopted these pre-engineered, fully standardized, all copper and copper alloy units.

For more facts, request Bulletin 1.1K5.

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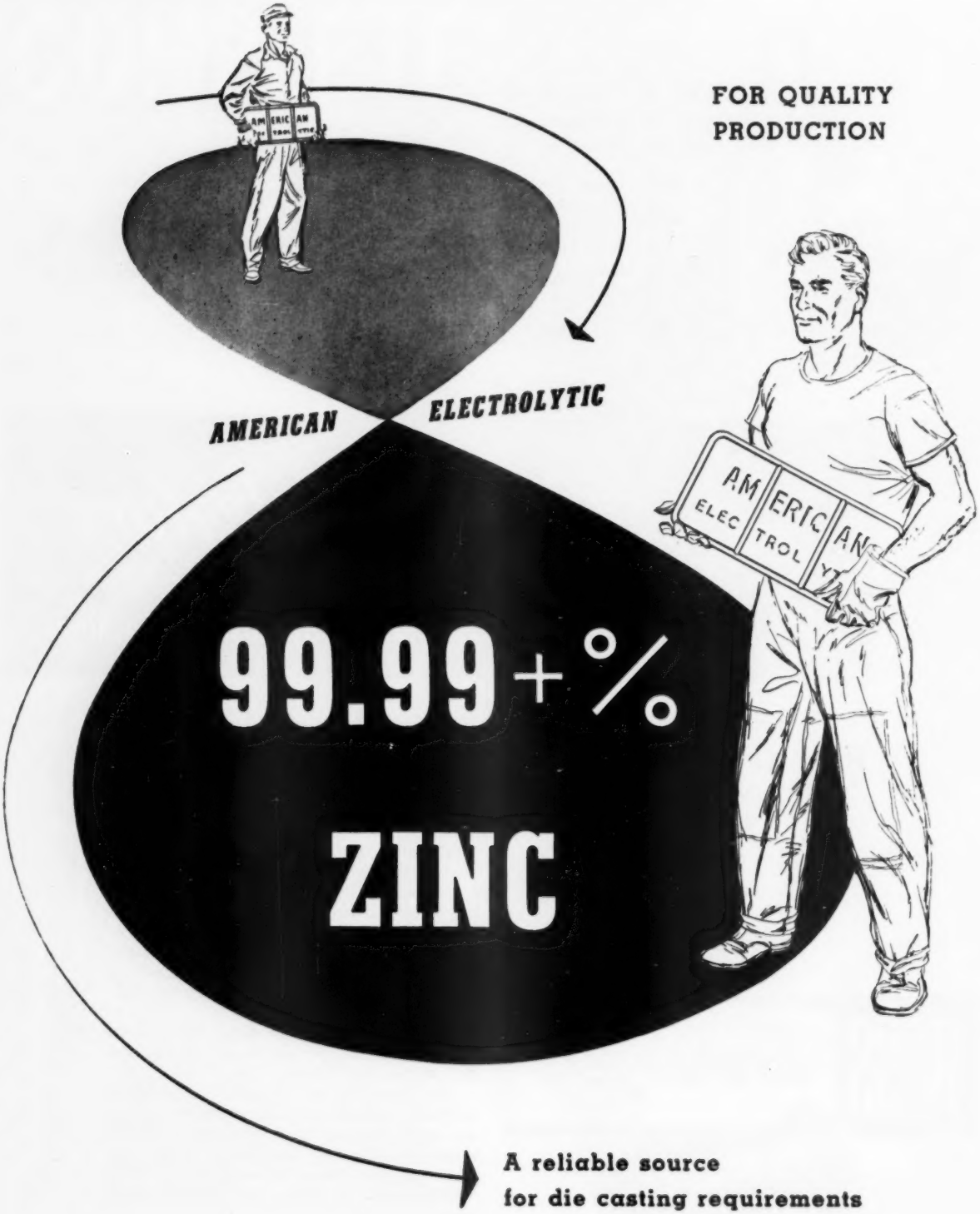

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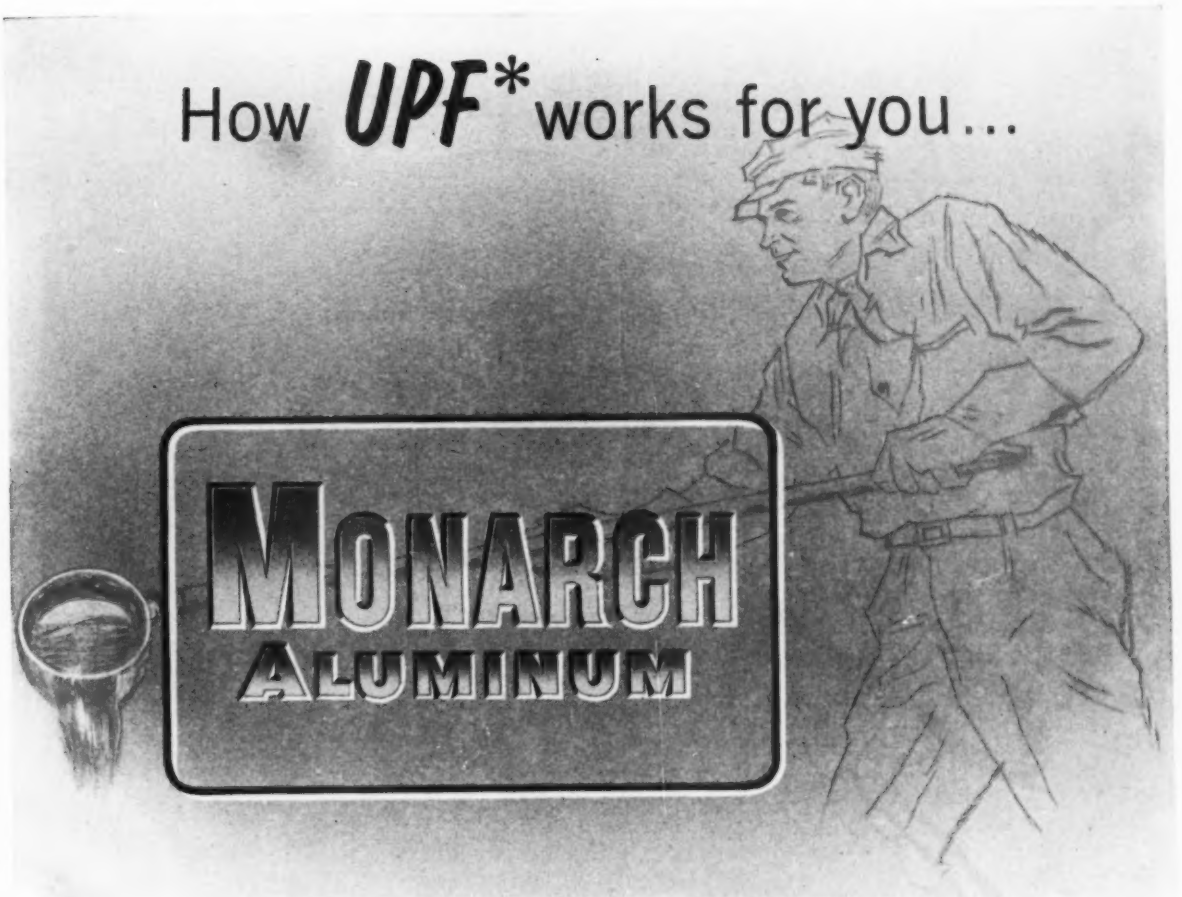

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CASTING + MACHINING + FINISHING

\+ = Better end-products at lower cost

ASSEMBLY

"Unified Production"—from castings to completed components give Monarch the wealth of experience necessary to solve your intricate casting problems. When you are designing a new product or reviewing one in production, rely on Monarch's unified responsibility to meet your quality standards—production schedules and budget requirements. Write today for Monarch's "Fact-File."

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ALUMINUM Permanent Mold Castings • ZINC Die Castings • ALUMINUM Die Castings • MACHINING • FINISHING • ASSEMBLY

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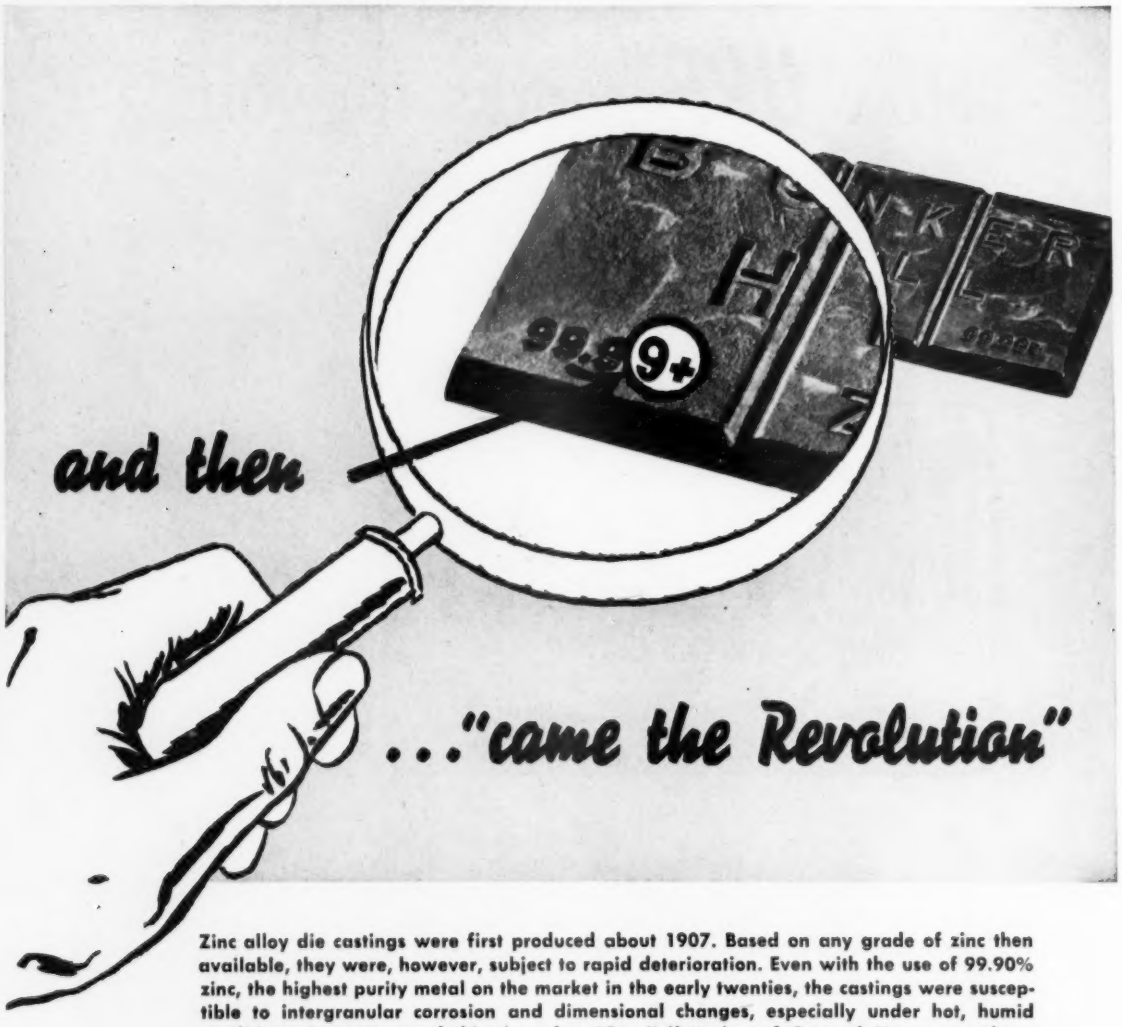

Zinc alloy die castings were first produced about 1907. Based on any grade of zinc then available, they were, however, subject to rapid deterioration. Even with the use of 99.90% zinc, the highest purity metal on the market in the early twenties, the castings were susceptible to intergranular corrosion and dimensional changes, especially under hot, humid conditions. It was around this time that "Boss" Kettering of General Motors — perhaps sensing the possibilities inherent in the die casting process and its potential value to the automotive field — said to an early die casting experimenter: "Give us *stable* die castings, and you'll have a big market in our industry."

Early tests had indicated that the impurities in the base metal were responsible for the casting's dimensional instability and thus limited their field of application. The chief obstacle to the expansion of the young die casting industry was the fact that a grade of purer zinc was not being produced at that time. This obstacle was overcome in 1928 with the first commercial production of a 99.99+% metal — BUNKER HILL ZINC — and, as expected, it revolutionized the die casting industry.

The tonnages of zinc consumed annually by die casters in the early twenties amounted to a few thousand tons, and the application of castings were limited to the automotive and a few other fields. In recent years, the use of zinc alloy die castings has spread into industries too numerous to mention, with consumption averaging nearly 300,000 tons of Special High Grade Zinc annually. Bunker Hill still continues to pioneer in the production and the quality control of the highest purity zinc metal.

EASTERN SALES AGENTS ST. JOSEPH LEAD COMPANY 250 PARK AVENUE, NEW YORK 17

BUNKER HILL 99.99+% ZINC

SALES OFFICE FOR PACIFIC COAST NORTHWEST LEAD COMPANY SEATTLE, WASHINGTON

improve product design . . .

cut manufacturing costs

with ACCUMET PRECISION INVESTMENT CASTINGS

In many cases design is restricted and function limited when alloy steel parts are made on conventional machinery from bar stock or forgings. Frequently such designs can be improved and production costs lowered by the use of precision investment castings. That's because this casting process permits the use of high alloy steels that are difficult to machine or forge.

Take these four component parts of a pneumatic tool for example. They are Accumet Investment Castings made by Crucible of 8620 steel. They have a smooth, satiny finish and are held to very close tolerances. If these parts were not made by this "lost wax" process, the pneumatic tool could not be produced at a practical cost in its present design.

Crucible engineers and metallurgists are available to help solve design and production problems through the use of Accumet Precision Investment Castings. Write now, and let them help you solve yours.

Visit us at Booth 241, National Metal Show, Cleveland, Ohio, October 19-23

CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking **ACCUMET PRECISION CASTINGS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

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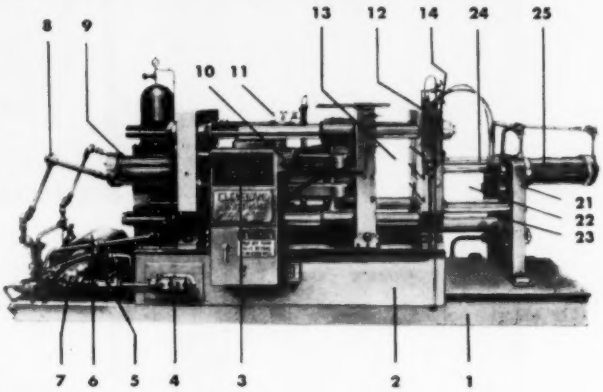
Why you can count on CLEVELANDS

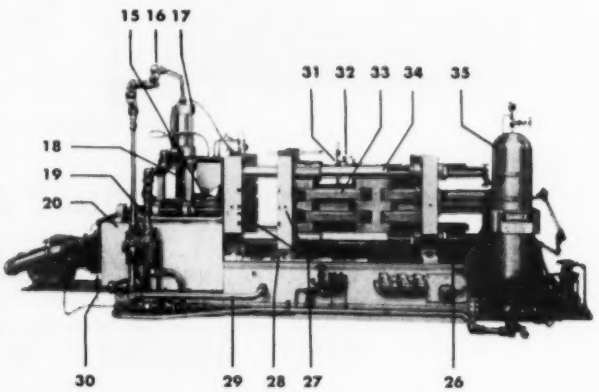
to give you precision quality die castings at a highly profitable rate of production

35 POINTS OF DESIGN AND CONSTRUCTION SUPERIORITY have made Cleveland Die Casting Machines the leader in this field. Many of these features are exclusive with Clevelands . . . others were pioneered by Cleveland and are now in general use throughout the industry. *All* add up to give Clevelands the qualities so essential for successful die casting:

- Rugged, rigid construction throughout for dependable, economical performance
- Powerful die locking pressure
- Fast, shockless die closing and opening for high production operation
- High metal injection speed to produce sound, dense, "hardware finish" castings
- Safe and simple control—manual or automatic
- Ample elbow room for die mounting and machine maintenance
- Universal construction — easily convertible — for either hot or cold chamber operation

These are the reasons why Clevelands are selected by many of the nation's most experienced die casters . . . why *two* of the country's foremost die casting producers have installed 32 Clevelands each . . . and a *third* has installed 33! And why Clevelands can be found in 'round-the-clock production in 12 foreign nations as well. Let a Cleveland Engineer show you how Cleveland Machines can improve your production with money saved!





MAKE A POINT-BY-POINT COMPARISON OF CONSTRUCTION FEATURES . . . THEN YOU'LL CHOOSE *Clevelands!*

Bulletin 400 gives you complete details. Write for your free copy.

Photographs above, with 35 points of Cleveland superiority indicated, show front view of the widely-used Cleveland Model 400 with aluminum shot end, and rear view of the Model 400 with zinc shot end. Cleveland Model 400 has 36" x 38" die plates; 400 tons locking pressure. Other Cleveland machines include the Model 200, 30" x 31" die plates; Model 100, 22½" x 24½" die plates; Model 50, 18" x 22" die plates.

QUICK DELIVERIES NOW POSSIBLE ON MOST MODELS

THE CLEVELAND AUTOMATIC MACHINE COMPANY

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DIE CASTING—

for products that call for sturdiness plus elegance ...at moderate manufacturing costs

CASE HISTORIES FROM MT. VERNON FILES

You can appreciate the four outstanding characteristics of this Brumberger product within a minute of seeing it:

(1) attractive appearance

(2) luxurious feel

(3) sturdiness

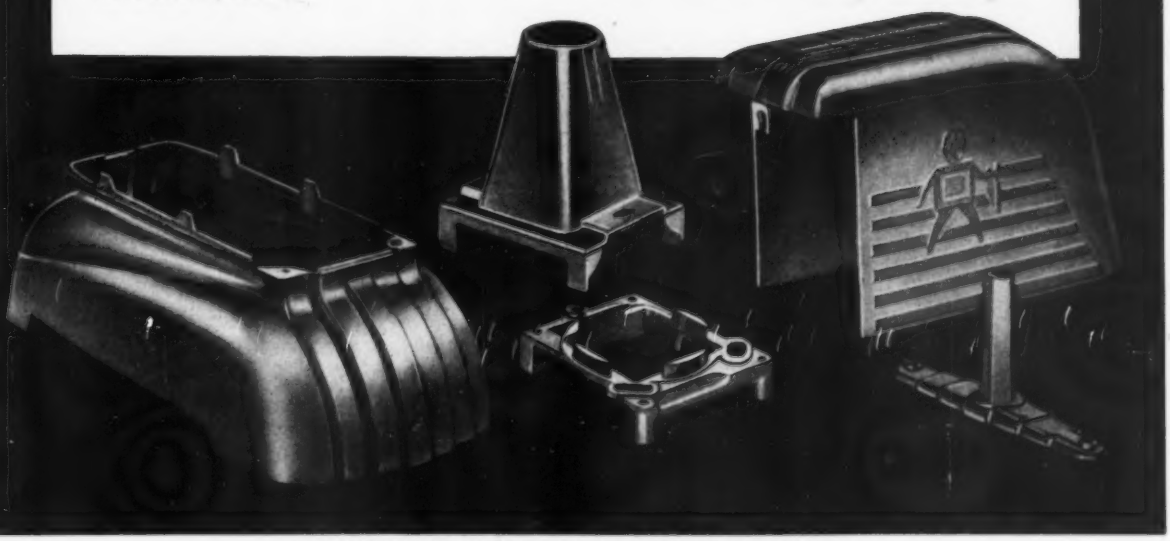
(4) extremely light weight

In time past, the Brumberger Company, of Brooklyn, N. Y., was accustomed to stamp all the parts of its photographic products from sheet steel, but today all units for the Deluxe Slide Projector are die cast.

Says Brumberger: "For an item such as our new 300-watt slide projector, which is styled to please the eye with gracefully curved surfaces and flowing lines, and engineered to give a lifetime of service, die casting is the supremely advantageous method of manufacture. Not only do we obtain a very good looking, lightweight, high-performance product, but the speed and economy inherent in the die casting process helps to hold down our manufacturing costs."

Perhaps you, too, have a product that requires to be both sturdy and elegant; or, perhaps the emphasis rests on only one of these attributes. However it may be, you'll profit by considering Mount Vernon die casting. Whether your specifications be simple or complex, we feel confident we can show you the way to economical output of quality merchandise.

MT. VERNON
DIE CASTING CORP.
MT VERNON NEW YORK



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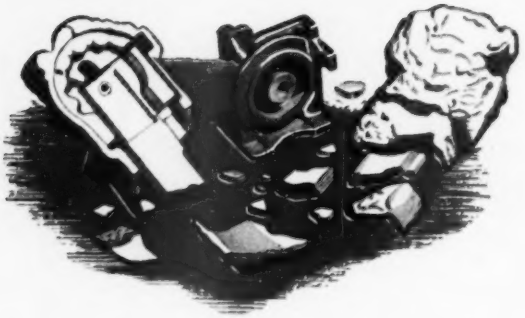

when a part can't be cast... "INTRICAST" it

Ever figured out the formula and the curves for a part, then had to compromise with efficiency in order to come up with a design that *could* be produced in quantity at low cost?

That's the time to think of "Intricast" . . . an ingenious way to make patterns in frozen mercury that permit fast, high-finish castings of highest accuracy and intricate contour to be made on a production line.

The story of "Intricast" parts is too long and too dramatic to be told fully here . . . but write for our 8-page booklet MP-531 which gives all the details. A sales engineer can call at your convenience to help engineer "Intricast" parts into your products.

Metallurgical Products Division

Thompson Products, Inc.

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STEEL INSTRUMENT HOUSINGS—
preferred design by investment casting

By H. RUF*

OF the many intricate parts that go into the make-up of a gyroscope some would not be possible without investment casting. This does not imply that prior to the industrial application of investment casting there were no gyroscopes, but rather that some preferred designs are now possible that could not be used before.

Consider, for example the inner gimbal shown in Figure 1. From an operational stand point the design of this piece is highly desirable, but except for investment casting, the manufacture of such a part would be economically impossible.

True, a sand casting might be made and then machined, but the chances of ending up with even a fair percentage of usable parts is slight. Also, with some modification it might be possible to machine the part from bar stock but the cost would be prohibitive. In either case the desirable thin wall section could not be achieved since there would be no method of including the external ribbing that stiffens the part without causing undue thickening of the over-all wall.

The nature of this piece is such that where machining is necessary it usually requires a degree of precision that cannot be achieved by investment casting. Overall tolerances of ± 0.0001 are not uncommon. For this reason, the vendor, the International Nickel Co., is held to ± 0.005 per inch tolerances on practically every dimension. While this accuracy is a specification requirement, the foundry

continued on page 98

1. EXTERNAL RIBBING on this investment cast gimbal for a gyroscope gives extra strength without excessive weight.

*Vice President, H. O. Boehme Inc., New York, N. Y.

1. ALWAYS TROUBLESOME in the sand foundry, these valve castings now are produced by shell molding with greatly lowered rate of rejection.

10,000 STAINLESS STEEL VALVE BODIES PER YEAR IN SHELL MOLDS

By H. J. COOPER*

A little over a year ago, technics for casting stainless steel in shell molds were announced by our foundry. Increased metal yield, better tolerances, fewer rejects, superior surface finish, minimized cleaning problems and better working conditions were among the many reasons given for the substantial investment in research and production equipment.

With many months of production experience we are now in a much better position to describe the methods and to evaluate results. It is the purpose of this article to present concisely in fact and photograph, the major steps in the mass production by shell molding of ½ inch stainless steel gate valve bodies, Figure 1.

EDITOR'S NOTE: There has been a scarcity of specific information on the shell mold casting process, concerning both the methods and the end products. Here is a brief report on some phases of the shell mold casting of a stainless steel valve body.

To start with, this was always a troublesome item in the foundry. Maintaining dimensional stability and preventing shifts was not easy and rejection rates were always rather high. With quantities estimated at 10,000 per year, it was decided at an interdepartment conference, that here was a job for the shell mold division.

Special aluminum patterns were designed, cast and mounted on aluminum plates as shown in Figure 2. These pattern plates are 13½ inch square, weigh 20 lb. each and cost approximately $600.00. Mounting both halves in the machine produces two matching shells every cycle, which in this case means roughly 150 gate valve molds or 600 gate valve bodies per 8 hour day. Figure 3 gives a real close up of the resin bonded shell molds.

One of the major advantages of the shell mold process is the fact that molds can be made on a production basis and then stored until needed. Figure 4 shows a rather unique shell mold rack which permits easy compact storage in a minimum of floor space.

When the time comes for pouring, the light weight shell molds are removed from the storage rack and placed in the simple support shown in Figure 5. After shake out castings are cut apart, cleaned and sent to machine shop for finishing operations. Proof of the statement that shell molding greatly simplifies handling and substantially increases yield is shown by the fact that the

*Executive Vice President, The Cooper Alloy Foundry Co.

Steps in producing gate valves . . .

2. PATTERNS are cast in aluminum and mounted on aluminum plates at a cost of about $600.

3. RESIN-BONDED SHELLS are formed over the patterns, about 150 molds per 8-hour day.

4. MOLD RACK allows compact storage with minimum use of floor space. Molds can be made in advance & stored.

5. POURING CASTINGS is done after mating shell mold halves are placed in a simple support.

6. CLUSTER OF CASTINGS from shell mold weighs only 10 pounds, compared with 21 pounds when sand cast.

poured weight of this cluster of four bodies, Figure 6, when made conventionally is 21 pounds as compared with 10 pounds when cast in shells. The superior surface finish minimizes machine time and provides greater legibility of identifying codes.

TABLE I
Facts and Figures

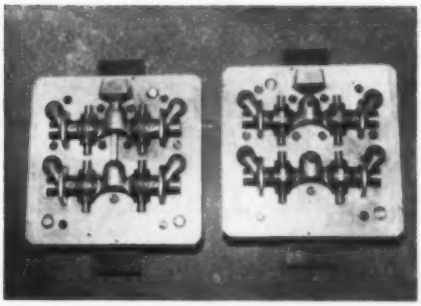
SAND MIX:
87% Sand 160 AFS fineness
8% Resin
5% 200 Mesh iron oxide

CORES:
Washed, oil bonded sand cores

SHELL MOLD MACHINE:
Sutter Products Co., Dearborn, Michigan
Platen Size Roughly 26 x 41
Cycle time = 2½ min.

PATTERN:
13½" sq. aluminum plate — cast aluminum parts

SHELL MOLD:
13½" Square, Weight approximately 7#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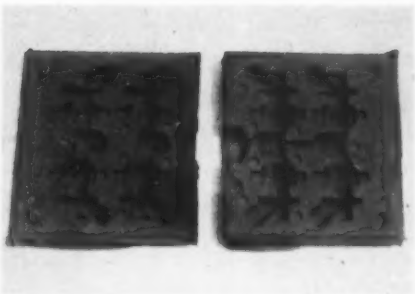
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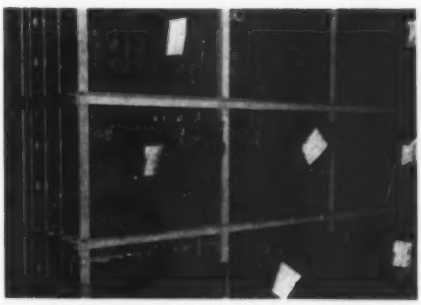
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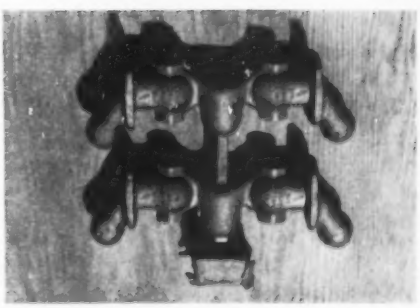
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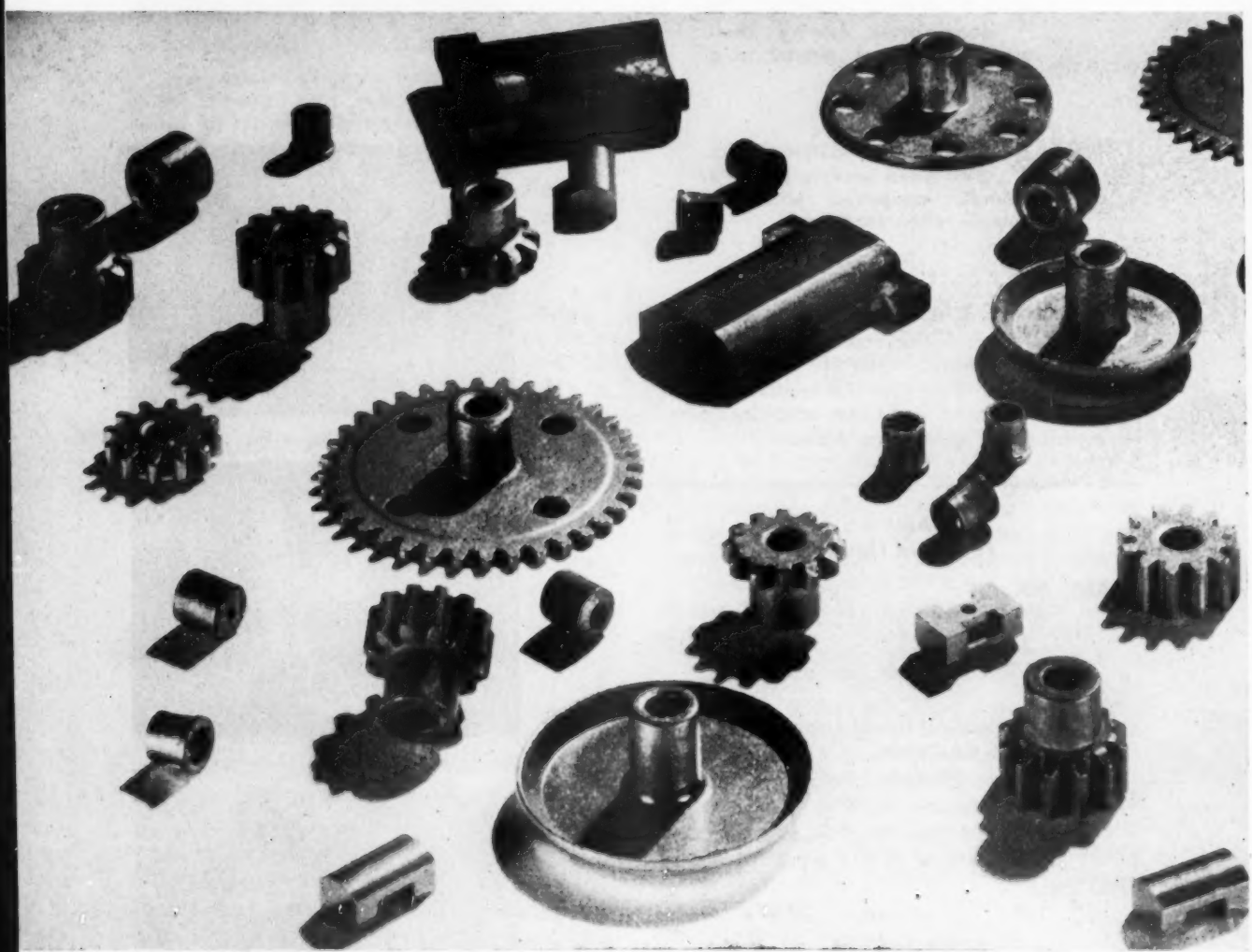
THE TOY INDUSTRY – why it uses powdered metal parts by the million



LOW cost manufacturing is the motivating factor for the use of powdered metal parts. However, this can be broken down somewhat to clarify the reasoning behind their use. Such a breakdown would include: quantity of duplicate parts, size of the individual parts, elimination of assembly operations, precision of manufacture and lower tooling costs.

About 30 different pieces at A. C. Gilbert Co. are made from metal powders at a cost reduction of from 25 to 40 percent, 30 more are being studied for conversion and there is little doubt that within the next year all of these parts and possibly more will be made as powdered metal parts.

The experience of this company is quite typical for the toy industry and is probably equally as typical for every industry that utilizes a reasonably large number of small duplicate parts.

Quantity of duplicate parts

Generally speaking, toys are made "by the millions". Certainly the number of units is extremely large, particularly when one considers that most toys must be considered as expendable. This one factor alone makes powder metallurgy a most attractive method of manufacture since fabrication of the parts is largely automatic as far as the green compact is concerned.

Once a press is set up, production carries on with very little attention other than to maintain a constant supply of metal powder in the hopper and to remove the green pressings as they are formed. Both of these operations require a minimum amount of skill and can use low cost labor.

Substantially the same conditions exist in the powdered metal parts operation so that the over all direct labor costs are as low as possible. Runs of several million pieces from the same set of tools and with only minor attention by skilled mechanics are the rule rather than the exception.

Size of the individual parts

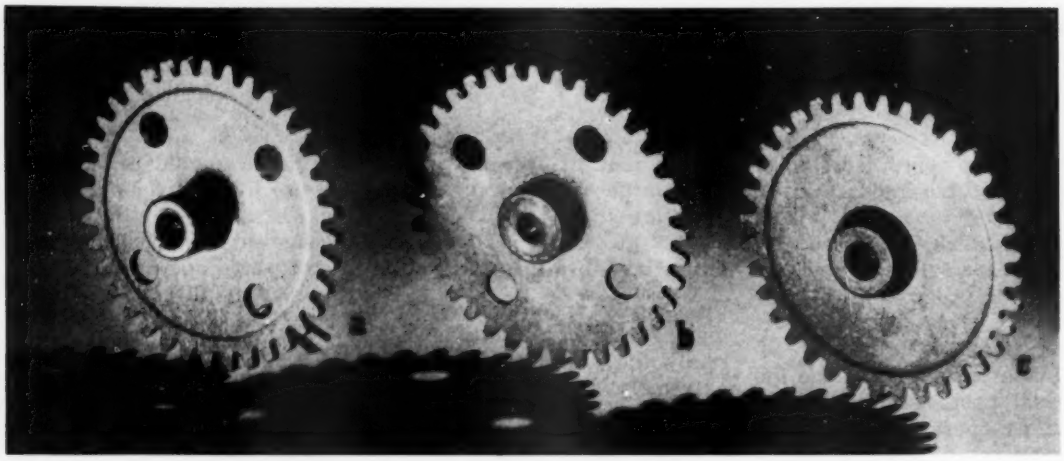
The individual components which go to make up a toy are generally small. While some substantially sized pieces are used they are mostly of a class that lend themselves best to fabrication from thin sheet or strip stock on punch presses. Of the other parts which would include wheels, pulleys, gears, mounting brackets, etc, most are rather small. It is the ex-

continued next page

Part	Old Mfg. Method	Present Mfg. Method	Material	Finish	Tolerances
FLAT GEAR	Blank, pierce, make hub on screw machine stake gear to hub.	Press @ 40 tsi sinter 40 min. @ 2050F	47% sponge iron 47% H_2 reduced iron 5% copper 1% graphite	Tumble to debur. Peen-plate with bronze.	Thickness ± .0025 Pitch dia. ± .0005 Hub length ± .001 Hub bore ± .001 Concentricity .0015 TIR Flatness ± .0015
CAR TRUCK WEIGHTS	None	Press @ 25 tsi sinter 40 min. @ 2050F	Same	Tumble to debur. Steam oxidize.	Thickness ± .0025 Hole ± .0025
DIESEL WHEEL	Machine from bar stock	Press @ 15 tsi sinter 32 min. @ 1900F	40% copper 60% sponge iron.	Tumble to debur. Vulcanize on tire.	Tire seat thickness ± .0015 Diameter ± .0025 Hole bore ± .001
BRONZE BUSHING	Machine from bar stock	Press @ 10 tsi sinter 45 min. @ 1550F coin @ 5 tsi	Copper-graphite-tin bearing Bronze mix.	Oil impregnate after coining.	Bore dia. ± 0.00025 Length ± 0.0005 Weight ± 0.025 gms.

NOTE: All dies cemented tungsten carbide, punches high carbon-high chromium tool steel hardened to 66 Rc

Here's how this toy manufacturer makes better gears at lower cost . . .



. . . In place of a two-piece assembly involving three operations (b) he uses powder metal gears (a and c).

ceptional part that has a projected area of much over one square inch.

Because of their smallness these parts can be made on high speed, low pressure presses. As noted above these presses are fully automatic and where the parts are small enough and needed in sufficient quantities they can be produced at the rate of several hundred per minute.

As the size increases, the press capacity must increase and at the rate of production decrease. However, this is not peculiar to powder metallurgy but is true of any forming operation that requires the use of either mechanical or hydraulic presses. To some extent it is even true of such operation as screw machines.

The small average size of the individual components is, therefore, another compelling reason for the use of powdered metal parts.

Elimination of assembly operations

In any manufacturing process the elimination of separate machine operations and subsequent assembly of components into a completed part can represent a material cost saving. In the toy industry this is as true as in the manufacture of automobiles. Consider, for example, a small gear — a very common component of many toys.

A technique has been developed for the manufacture of small gears that is used almost universally. The gear is blanked from strip stock and, if precision demands it, restruck or shaved. The hub is made as a separate piece on a screw machine and the two pieces are then assembled by staking, rolling, brazing or some similar method. It should be noted that as the accuracy requirements of the gear increase, the precision of all of these methods must increase with of course, increased manufacturing costs.

Now, consider powder metallurgy as a manufacturing method. The gear and hub are molded as a single piece at about the same rate as the blanking operation on the gear. The piece is sintered and is then finished and ready for assembly in the toy for which it is designed.

Both the screw machine and the sub-assembly operations have been eliminated as has practically all scrap loss. The precision is greater than can be achieved by other methods and in some cases the unique self lubricating properties of powdered metal parts may eliminate the inclusion of some sort of lubricating system.

The gear used as an example is only typical and there exist innumerable other parts where similar savings by the elimination of assembly operations are being made or could be made.

Precision of manufacture

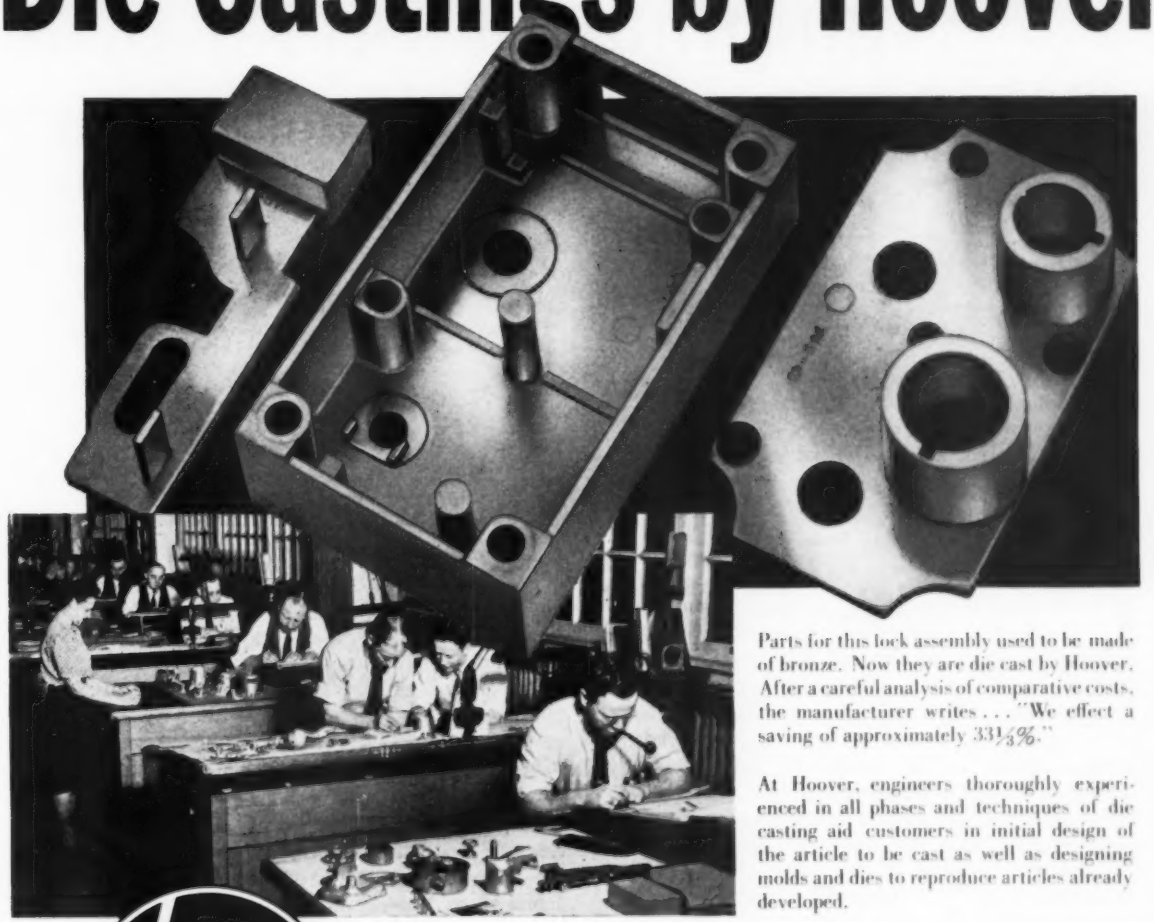
Because of the method of assembly of components, parts for toys must, of course, be completely interchangeable. This means working within rather close tolerances at a low cost level; normally these two factors do not go together. With powder metallurgy as a fabricating method, however, these two factors are completely compatable.

Assuming that the dies are made of a material suited for

continued on page 120

Lock manufacturer finds key to 33⅓% cost reduction in

Die Castings by Hoover



Parts for this lock assembly used to be made of bronze. Now they are die cast by Hoover. After a careful analysis of comparative costs, the manufacturer writes . . . "We effect a saving of approximately 33⅓%."

At Hoover, engineers thoroughly experienced in all phases and techniques of die casting aid customers in initial design of the article to be cast as well as designing molds and dies to reproduce articles already developed.

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ARE HIGH DENSITY PARTS practical by powder metallurgy?

CAN moderately highly stressed structural parts made by powder metallurgy compete with other materials? The first answer to this is yes, if an infiltrated part is made. But where infiltration can not be effected only high density sinterings can be considered. These latter products are usually thought to be uneconomical since the processing costs are somewhat higher than for low density parts, die life is considered to be somewhat lower and the high purity raw materials that have generally been used are too expensive for most applications.

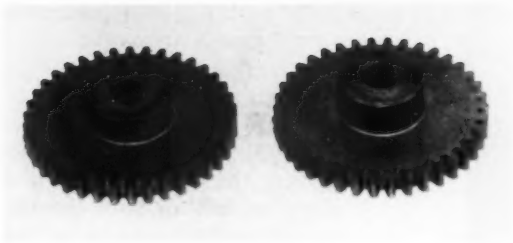
Sponge iron powder is pressed in steel dies without excessive wear

In the light of these objections one would be inclined to say that these sinterings cannot compete with other methods of fabrication. But, the following description of three high density parts currently being made indicates how powder metallurgy is producing, at lower costs, parts that had formerly been made by other fabricating processes.

Before describing the parts, some general notes are of value. Heretofore, it has been considered necessary to use only electrolytic iron in the fabrication of high density ferrous sinterings. This has come about by virtue of the higher green density that can be obtained for the same unit pressure when this grade of powder is used. Another reason for the use of electrolytic iron powder is its higher purity. The small silicon dioxide content of other powders was thought to give excessive die wear.

Regarding the first point, all of the high density sinterings currently being made utilize Swedish sponge iron to which is added from ½ to 1 percent of zinc stearate as a die lubricant. The only exception is for those parts where other characteristics such as magnetic properties, require the use of a different powder. At forming pressures and coining pressures of about 40 tons per square inch, the desired densities can be secured.

Abrasion of the dies by the silicon dioxide content of the powder has not been a problem. In most cases the same die is used for making the green pressing and for coining. Runs of over 100,000 pieces (over 200,000 pressings) have been made using a die steel containing 12 percent chromium, 1½ percent carbon and 0.80 percent molybdenum. The dies are hardened to Rockwell C 63 and the punches to Rockwell C 58. Thus far, no tools have had to be discarded due to excessive die or punch wear.



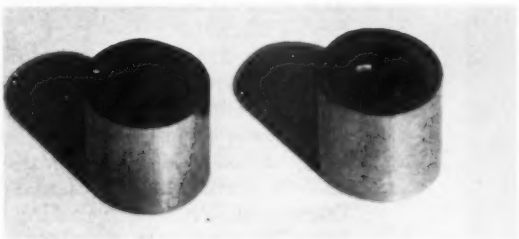
PART: Meter Gear

SPECIFICATIONS: High dimensional accuracy, crushing strength of 7500 lbs. applied at right angles to bore when bore is horizontal.

FORMER METHOD OF MFG: Machining from a steel forging.

PRESENT METHOD OF MFG: Press from iron powder at 40 tsi, sinter for 45 min. at 2050F in dissociated ammonia, coin at 40 tsi.

PROPERTIES OF SINTERING: Dimensional accuracy satisfactory, crushing strength 15,000 lbs. (Note, when a porous sintering of normal density was made the maximum crushing strength developed was 3000 lbs.). Final density, 87 percent of theoretical.



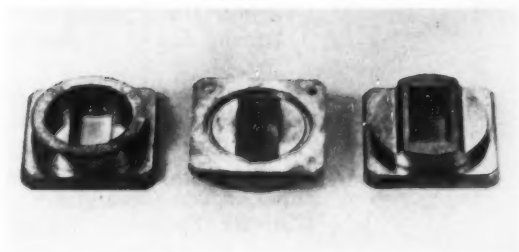
PART: Magneto Cam

SPECIFICATIONS: High dimensional accuracy, 2-3 percent nickel alloy, minimum density 87 percent of theoretical, smooth surface.

FORMER METHOD OF MFG: Machine from bar stock of proper composition.

PRESENT METHOD OF MFG: Press at 40 tsi. from iron powder to which 2 percent of nickel has been added. Sinter 45 minutes at 2050 F. Coin at 40 tsi.

PROPERTIES OF SINTERING: Satisfactory dimensional accuracy and surface finish. Final density 89 percent of theoretical. Alloy composition satisfactory.



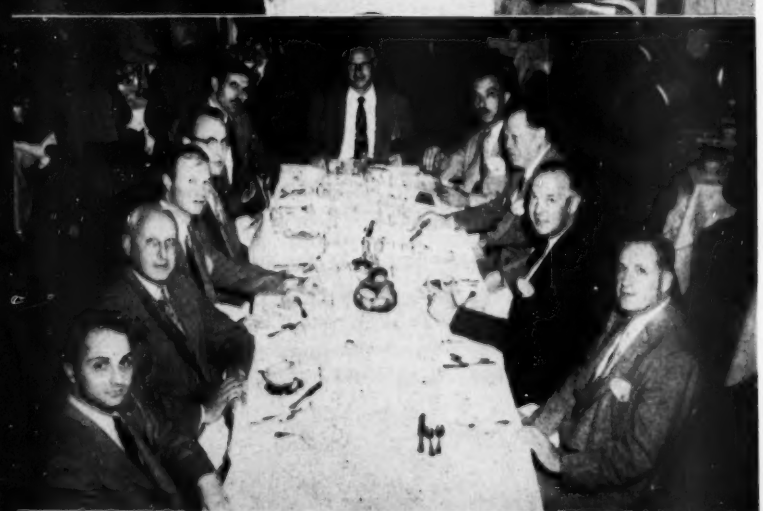
PART: Wave guide connector

FORMER METHOD OF MFG: Machine from brass stock.

PRESENT METHOD OF MFG. Press from iron powder; sinter 30 minutes at 2050F; Coin at 40 tsi.

PROPERTIES OF SINTERING: Final density 90 percent of theoretical, hole size is more uniform than when machined, finish is smoother. All parts shown here courtesy of American Sinterings Div., American Tool Works.

RECORD ATTENDANCE MARKS ADCI SILVER ANNIVERSARY MEETINGS



THE second quarter century of American Die Casting Institute activity was given an enthusiastic sendoff by a record attendance at the 25th annual meeting in Chicago last month. Nearly 400 guests were seated at the annual banquet which highlighted two days of business and technical sessions.

Reminiscence of past struggles for existence, and study of new projects for expansion of the Institute's work characterized the two-day meetings in Chicago's Edgewater Beach Hotel.

The Institute, now 92-members-strong, elected Geoffrey M. Rollason of Aluminum Company of America to serve as president during the 1953-54 term, with William J. During of Precision Castings Co., Inc., as vice president; David Laine as secretary and W. J. Parker, treasurer.

Mr. Rollason has served as vice president of the Institute since 1945 during the presidencies of A. J. Sanford of Cleveland Hardware & Forging Co., and Austin M. Lillegren of Madison-Kipp Corp.

Directors elected are: (Eastern Section) T. J. Walker of Mt. Vernon Die Casting Co.; W. J. During and G. M. Rollason.

(Central Section) George Rawls of Pressure Castings, Inc.; R. A. Luedtke of Schultz Die Casting Co.; H. H. Weiss of Superior Die Casting Co.

(Midwest Section) Charles Adams of Twin City Die Casting Co.; Henry Schroeder of

A few of the several hundred participants in the ADCI's 25th anniversary celebration are shown in these photos taken at PMM's annual luncheon for the Institute.

Milwaukee Die Casting Co.; Walter Brown of Kiowa Corp.

(Pacific Section) R. R. Dreibus of Harvill Die Casting Co.; A. W. Simpson III of Western Die Casting Co.; J. M. Davis of Union Die Casting Co.

Directors at large: F. J. Koegler of Doehler-Jarvis Div., National Lead Co.; L. G. Vanderhoof of Stewart Die Casting Div., Stewart Warner Corp; E. Anderson of Globe Imperial Corp.

Growth of uses for die cast ammunition components.

In the keynote speech of the meetings, Brig. Gen. Merle H. Davis, USA, ret., traced the history and future of die cast components in ammunition.

From a single zinc die casting — the fuze body for a hand grenade — which was the first functioning die casting utilized in ammunition during World War I, Gen. Davis told of improvements in design, in alloy and in tooling until **"by VJ day, the number of separate ammunition pieces specified for die**

continued on page 117

Active leadership will be supplied by . . .

GEOFFREY M. ROLLASON
President

WILLIAM J. DURING
Vice President

DAVID LAINE
Secretary

Die cast TV bezel starts at the die casting machine . . .

Goes through trim press and hand trimming operations . . .

Is inspected and packed for shipment . . .

And then painted and assembled .

TV INDUSTRY TAKES A GOOD LOOK - - AND BUYS

ALREADY a heavy supplier to the radio and electronic industry, die casting is being increasingly specified in the newer designs of top name TV sets. Ability to produce large, thin sectioned die castings with the "hardware" finish necessary for consumer goods has been an important factor in this trend.

For example, Precision Castings Co., Inc., is currently die casting TV bezels for the 17-inch and 21-inch range of Sylvania Electric TV line.

These bezels have sometimes been made as stampings, but the decision to die cast them in zinc is based upon a number of considerations:

- More rapid production and delivery of ready-to-finish die castings.
- Lower tool cost.
- Greater design freedom, particularly in the ornamental control knob area of the bezel.
- All attachment bosses are cast in position, reducing assembly time and cost.
- Because of uniformity and close tolerances, trouble-free assembly assured.
- Greater rigidity can be obtained in a die cast bezel.

The bezels are die cast in single cavity dies. In order to fill the die properly, heavy flash is provided so that a substantial flow of metal is obtained. This flash is removed in specially tooled stamping presses and by hand punching.

Final finish for these Sylvania bezels involves gold and coppery red organic coating, applied by spray painting at the Sylvania plants.

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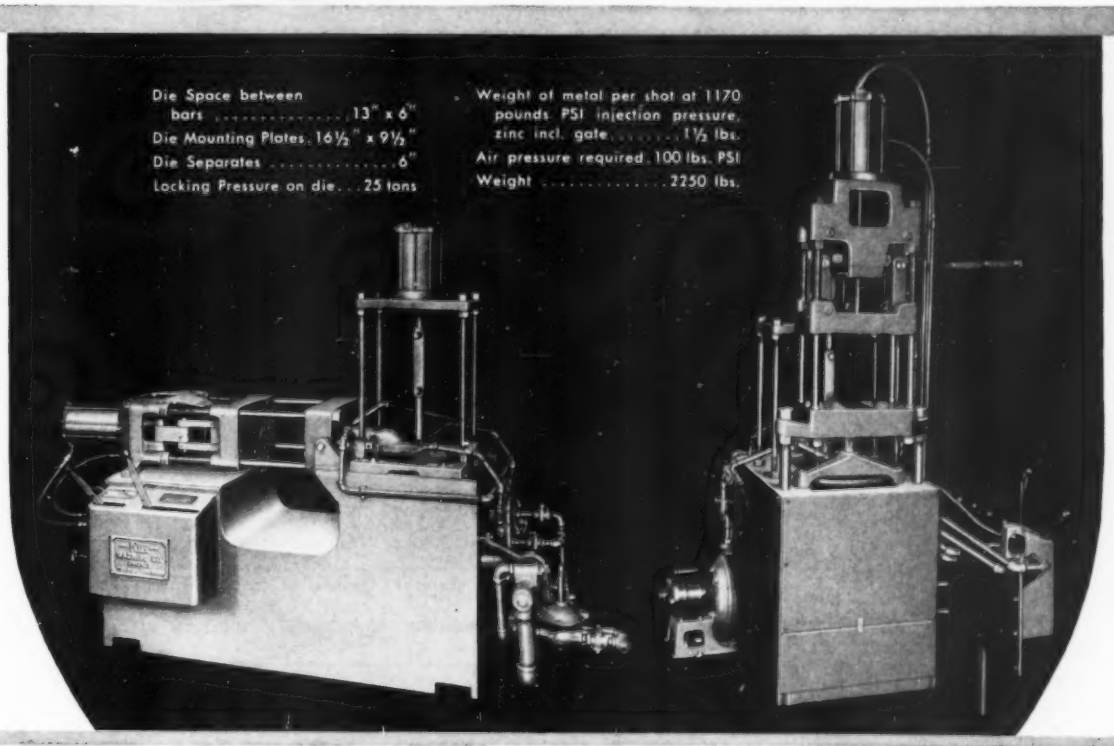
The Mighty MIDGET of Die Casting Machines

THE NEW KUX MODEL K

is the safest, most highly productive small die casting machine on the market! Available in horizontal or vertical center shot models, die castings weighing up to 1½ pounds in zinc are produced under high injection pressures, insuring quality, dense castings with minimum porosity. ***Compare these features:*** Center shot operation with floating nozzle always in seated contact with the die and one-piece gooseneck. Speed and power obtained by use of an air compressor to operate opening and closing of die, and metal injection plunger. Double safety lock, mechanical-electrical, prevents metal shot while die is in open position. Double toggle mechanism locking in two directions absorbs all locking pressures, operates on all four corners of die plate. Built-in ejector plate for positive ejection. Self-contained gas or oil firing unit.


Die Space between bars . . . . . 13" x 6"
Die Mounting Plates . 16½" x 9½"
Die Separates . . . . . 6"
Locking Pressure on die . . . 25 tons
Weight of metal per shot at 1170 pounds PSI injection pressure, zinc incl. gate . . . . . 1½ lbs.
Air pressure required . 100 lbs. PSI
Weight . . . . . 2250 lbs.

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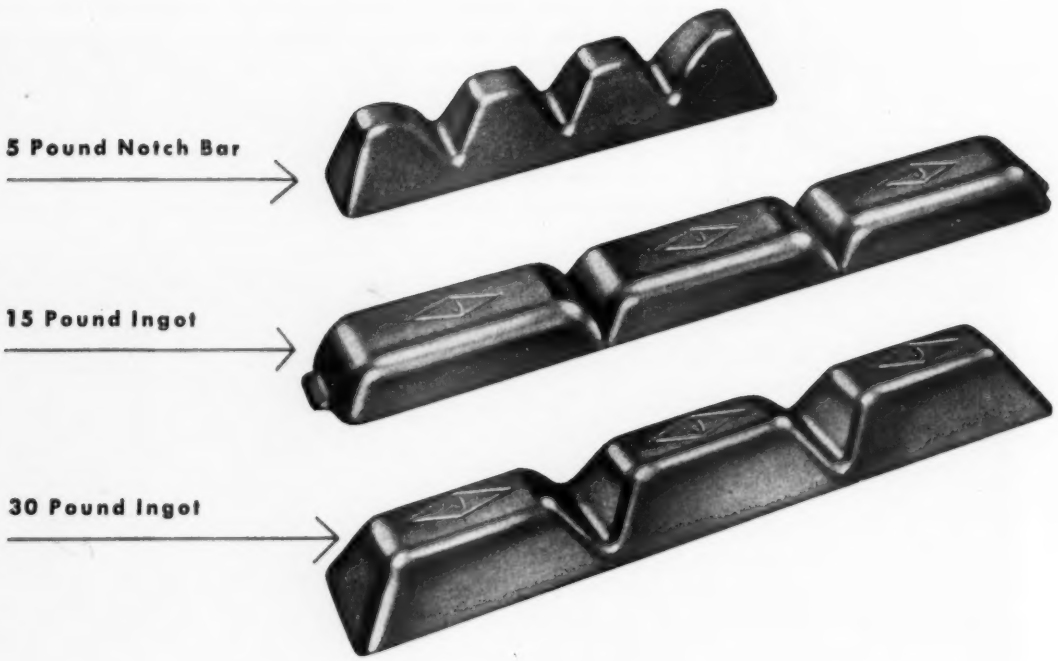

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IT PAYS to use PMM methods

By A. T. ABRAHAMS
Chief engineer, Racon Electric Co.

BY virtue of the closer dimensional tolerances that can be held by permanent mold casting as compared to sand casting, the thinner wall sections that can be cast, the lower secondary machining due to more intricate coring and the superior surface finish achieved; this method of production will very often show remarkable cost savings over sand casting.

A secondary advantage, though one of outstanding importance in many cases is the higher as-cast strength of a permanent mold casting as compared with a sand casting.

All of these reasons entered in the decision of Racon Electric Co. to convert many of their aluminum castings from sand to permanent mold.

The superior strength of a permanent mold casting over a comparable sand casting can be illustrated by the castings shown in Figure 1.

In the speaker bases pictured, several legs are cast projecting from the concave surfaces. These legs serve to support other components of the speaker and the step at the top of each one must be machined so that a proper seat is secured. When the speaker bases were sand cast, breakage of these legs during machining was a common occurence. This meant, of course, that the casting would have to be scrapped whenever such breakage

continued on page 88

1. LEGS ARE CAST accurately enough to be machined with hollow mill.

2. ONLY THREE machining operations are needed to finish this piece.

TYPICAL PART	COST OF S. C.	COST OF P. M. C.	COST OF MACHINING S. C.	COST OF MACHINING P. M. C.	SAVING
A	.20	.175	.82	.14	.705
B	1.57	1.10	1.10	.30	1.27
C	.19	.19 (1)	.46		.46
D	.90	.57	.40	.16	.57

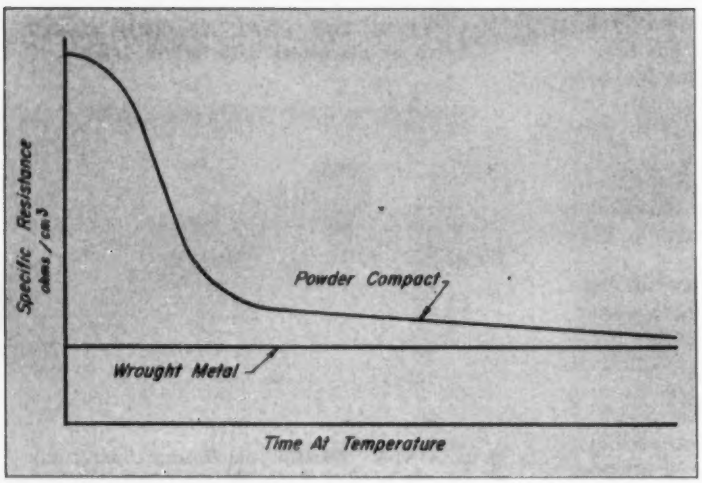
S. C. — Sand casting

P. M. C. — Permanent mold casting

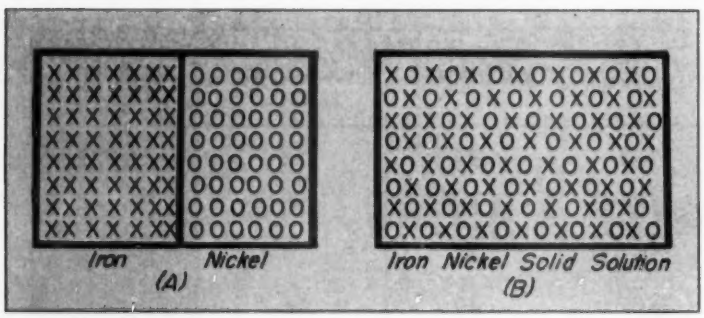
(1) This cost figure includes both casting and machining.

THE SINTERING PROCESS
Part One: Theory

By PHILIP R. KALISCHER
Associate Editor



1. CHANGE in specific resistance with time at sintering temperature.



2. SCHEMATIC representation of the solid diffusion process.

PERHAPS the most important, and the least understood, phase of the powder metallurgical process is sintering. It is well known that a green compact is placed in a furnace and heated, in a controlled atmosphere, to some temperature below the melting point of the metal. During this heating process, by some magical mumbo-jumbo, the individual metal particles are caused to bond together. This bond is sufficiently strong so that after cooling the sintered compact presents many of the properties of wrought metal.

Evidence of this change from a relatively weak to a moderately strong part is shown by the change in strength as measured by the maximum fibre stress. Typical figures for a pure iron compact are:

Green compact	1500 psi
Sintered compact	22,000 psi

The change in thermal and electrical properties is equally marked. The relative change in resistivity is shown in Figure 1. Here it is evident that from a piece having high resistance and hence little characteristics of a metal as we define it, the change on sintering is highly marked and the final piece is close to wrought metal in its electrical resistance. The

thermal properties will, of course, follow the electrical.

The question naturally arises, then, just what is the mechanism which causes these changes to take place? No simple, clear cut answer can be given since there are several interdependant mechanisms all of which play a part. The most important of these is, unquestionably, the process of solid diffusion.

One factor should be understood clearly at the very start. FOR SINTERING TO PROCEED SUCCESSFULLY THERE IS NO NEED FOR A LIQUID PHASE TO BE PRESENT AND, IN FACT, MAY EVEN BE UNDESIRABLE. The common idea that there always exists, at least at the particle boundaries, a liquid phase is completely fallacious. While the sintering temperature is usually high enough so that the powder particles are plastic this plasticity has no effect on the homogenization except as it is an indication of the temperature. What then is the process of solid diffusion in powder metallurgy.

Consider first two pieces of solid metal, say iron and nickel, placed so that two surfaces are in intimate contact as shown in Figure 2a. If good metal-to-metal contact were possible with no interfering materials such as dirt, grease, moisture or oxide films then there would be, over a period of time, a migration of atoms of iron into the nickel and of nickel atoms into the iron as shown in Figure 2b.

At room temperatures, the rate of atomic migration would be almost infinitely slow, but as the temperature is raised the rate increases. It has been shown that the dependance of rate of diffusion upon temperature can be expressed by the formula:

$$D = Ae^{-Q/RT}$$

where Q is the heat of activation
R is the gas constant
T is the absolute temperature
A is a constant

From this it is at once apparent that the rate of diffusion will increase extremely rapidly with increasing temperatures. Actually the value of D doubles for each 10 to 75 degree rise in absolute temperature, depending upon the system being studied.

Another relationship for rate of diffusion relates the dependance upon concentration gradient, time, and weight of material transferred. This relationship is:

$$dm = AD\frac{dc}{dx}dt$$

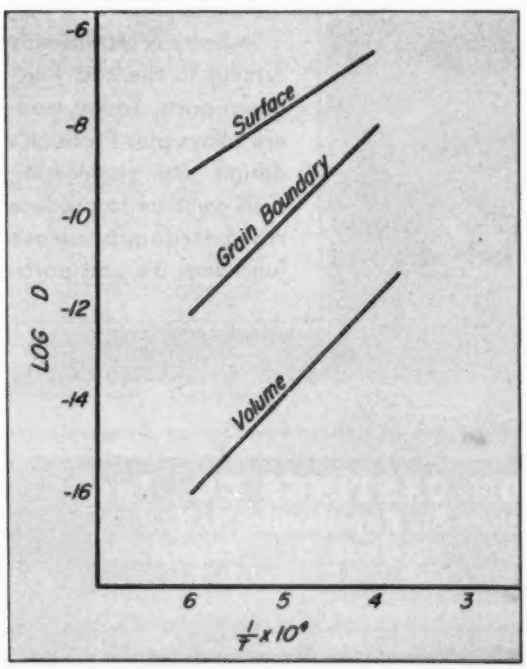
where dm is the weight of substance delivered
D is the diffusion coefficient
A is a constant
dc/dx is the concentration gradient
dt is the elapsed time

From this relationship we see that the rate of diffusion will decrease as the concentration gradient decreases and is linear with time.

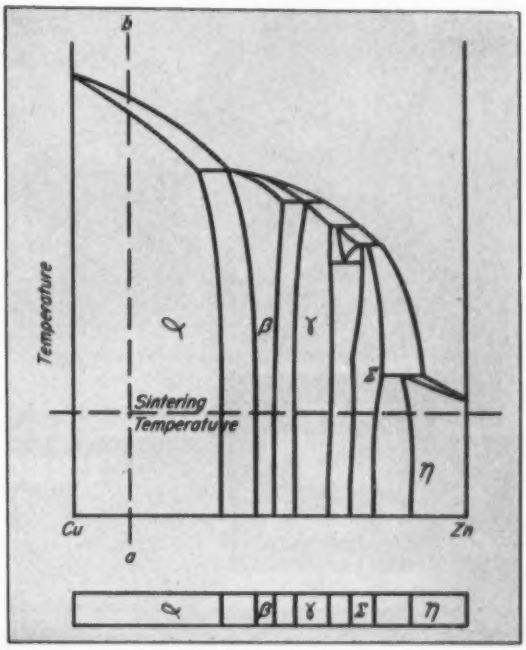
These relationships apply to massive metals, particularly the second one, and in dealing with metal powders the relationships become so complex that a mathematical solution becomes impossible. For this

continued on page 109

3. **RELATIVE** rates of diffusion (T is absolute temperature).



4. **APPROXIMATE** phase diagram for the Cu-Zn system.



No Problem's Too Tough

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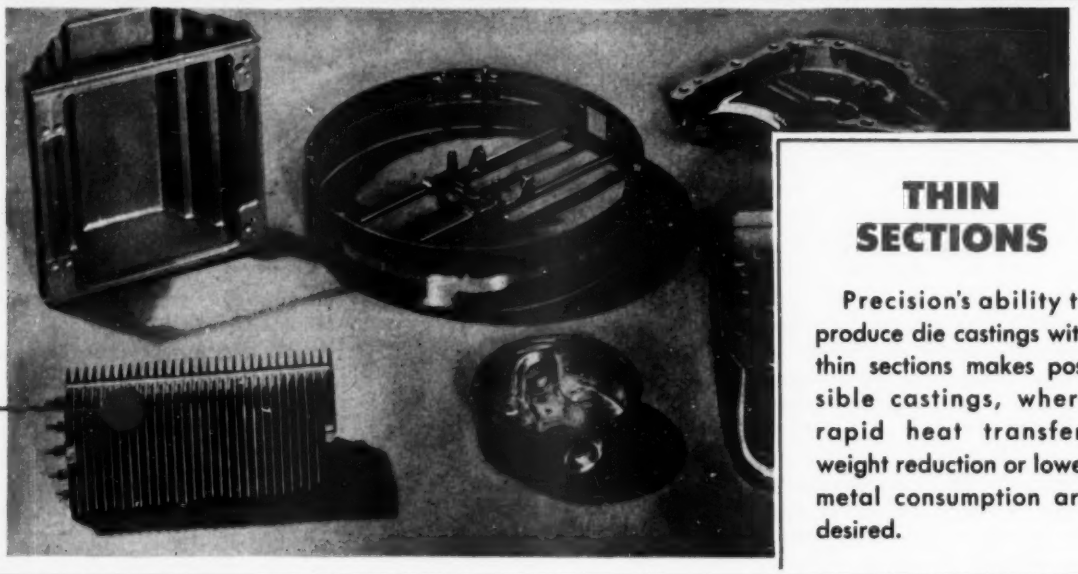

THIN SECTIONS

Precision's ability to produce die castings with thin sections makes possible castings, where rapid heat transfer, weight reduction or lower metal consumption are desired.

FUNCTIONAL PARTS

Industry is increasingly turning to die cast functional parts. Today modern alloys plus Precision's design and engineering skills combine to produce rigid, strong, accurate functional die cast parts.

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For additional information Circle No. 33 on the Reader Service Card

Where aluminum die castings are used TO WITHSTAND HIGH STRESS

By GEORGE W. COLEMAN*

THERE are two points in a pruning shear where the stresses may be exceptionally high. At or near the pivot extremely high compressive stresses are generated and in the handles exceptional bending stresses may be encountered. Because of these remarkably high unit loadings, pruning shears are generally forged steel. Substitute aluminum die castings for the steel and one would expect to have a tool limited to the cutting of twigs and small, green material.

In spite of what might be thought to the contrary, the pruning shears made by the Parker Mfg. Co., Figure 1, are entirely aluminum die castings except for the one steel cutting blade, the pivot pin, a die cast zinc catch and the spring. Yet these shears will cut dry hardwood of any size up to the maximum that will fit into the jaws.

From Figure 2 it can be seen that the section design is such that the cross-section is the greatest at the points of maximum stress. The particular alloy selected for this job is, of course, a high strength material containing about 9 percent silicon, 2 percent iron, and 4 percent copper. This alloy has a yield strength, at 0.2 percent offset, of about 26,000 psi in the as-cast condition.

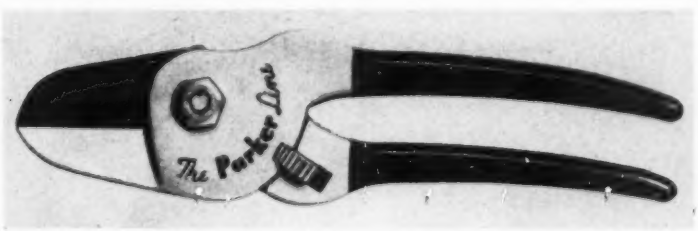
Die casting gives certain advantages over conventional sand casting. Because of the more rapid chilling the average grain size is smaller. Generally speaking there is a more random orientation of the grains rather than the columnar structure characteristic of sand castings and there is a marked absence of dendrites. All of these factors combine for a stronger as-cast structure.

In addition a die casting is generally of higher density and better surface so that either internal or external pores or defects which could be points of high stress concentration are absent. These latter factors decrease failures by fracture, particularly under tensile loadings such as in the outer fibres of the handles.

All of the factors of superiority of a die casting over a sand casting plus design to give maximum section at points of high stress have made it possible to manufacture a highly successful shear using aluminum die castings.

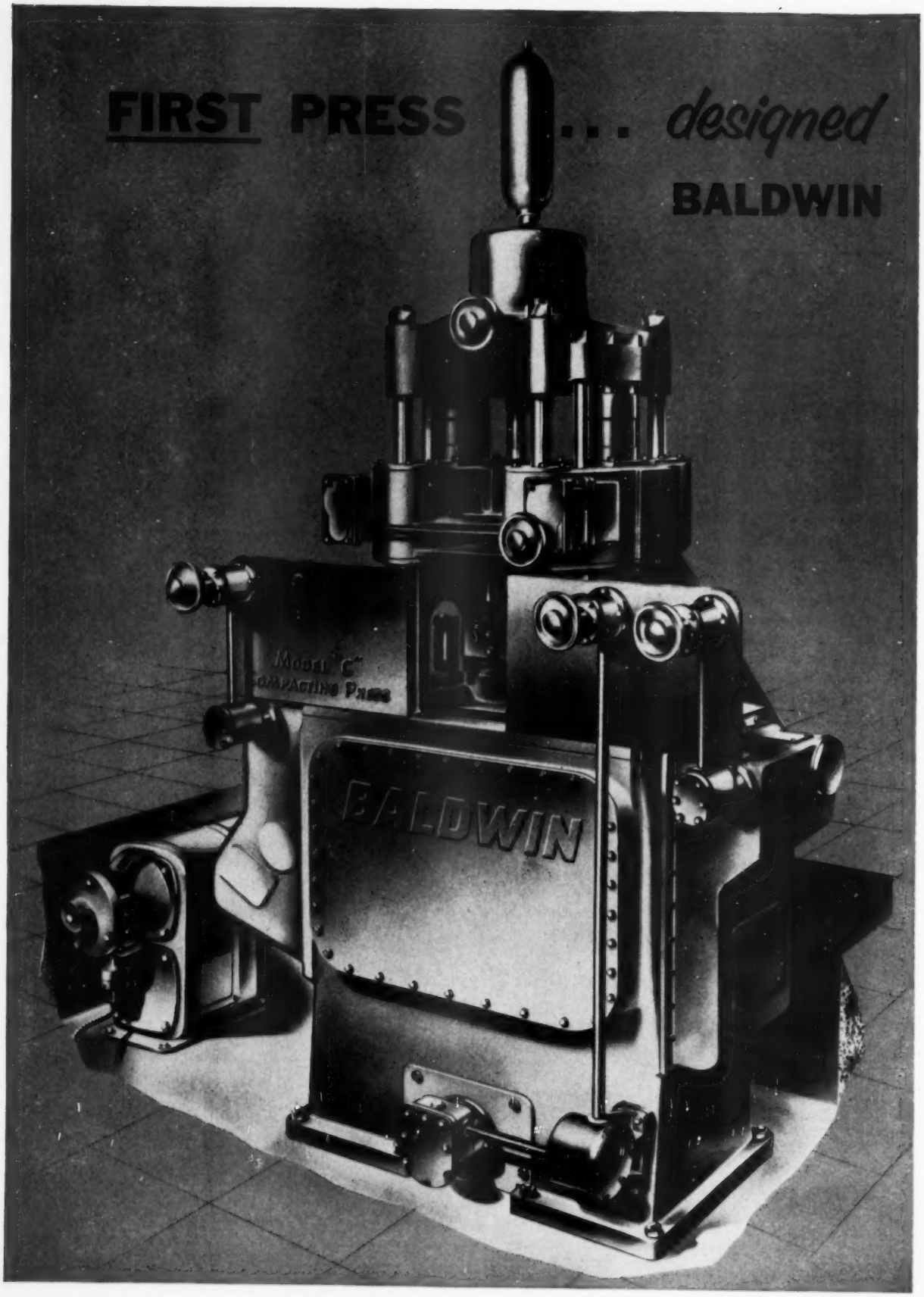
continued on page 123

*Chief Metallurgist, Parker Mfg. Co., Worcester, Mass.



1 CLEAN-LINED, strong, comfortable to hold, and light weight . . . attributes gained by die casting.

2. "BEEFED-UP" sections for strength but whittled down where weight can be saved, two die castings give a greatly improved shear.


FIRST PRESS ... designed
BALDWIN
BALDWIN

Specifically for Powdered Metal!

MODEL "C" COMPACTING PRESS

The new Baldwin-Defiance Model "C" compacting press, can be seen in action for the *first* time at the Metal Exposition, October 19-23 in Cleveland. A mechanical, four column, crank-type press with pneumatic clutch and brake, Model "C" was developed by Baldwin press-development engineers specifically to answer the *pressing* problems of the growing powdered metals industry.

Baldwin-Lima-Hamilton's experience in adopting standard compacting presses for powdered metals is unequalled. B-L-H knows the special needs of powdered metallurgy and to meet your requirements, designed Model "C" completely new from scratch, incorporating all of these features.

SEALED MECHANISM SHUNS ABRASION

The entire press mechanism, including a 20-hp motor, is completely enclosed and sealed to prevent entrance of abrasive materials, making it suitable for compacting powdered metal.

HYDRAULIC HEAD CONTROLS DENSITIES

Accurate pressure is assured by a hydraulic head whose ram supplies opposing pressure for the upper punch. Thus, if compressing pressure exceeds the hydraulic accumulator setting, the upper punch "gives" to and is held within the limit of the setting. This assures uniform densities of compacts, prevents overloading and prolongs the life of tools and press.

DESIGNED TO PRECISE FILLING OF DIE

This press uses an air-operated shuttle type feeder which moves from under a stationary hopper to a position over the die. The shuttle is supported on guide rods with a spring loaded cutoff ring to prevent loss of material. The depth of fill and the stroke of the bottom punch are adjusted by two separate handwheels, eliminating shimming the bottom punch to bring it flush with the top of the die. The relative position of the core rod to the die is also adjustable to aid in controlling the fill when making counterbored parts.

AUTOMATIC LUBRICATION

The lubricating system is equipped with a motor driven gear type lubrication pump, a filter, and a pressure switch. The main drive motor cannot be operated unless there is oil pressure in the lube system. Should the oil pressure drop below the pressure switch setting the main drive motor will stop.

CONTROLS PERMIT FIVE CYCLING VARIATIONS

1. Continuous run.
2. Press will stop at any pre-determined point in its cycle, dwell up to 15 seconds (adjustable) and start automatically.
3. Single stroke (stops at pre-determined point in cycle and starts only when start button is pushed).
4. Single stroke with dwell (combination of steps 2 and 3).
5. Press can be inched through its cycle.

SEE IT AT THE SHOW!

If you use or are planning to use powdered metals, it will pay you to visit Baldwin Booth No. 1139 at the Metal Exposition in Cleveland, Oct. 19-23. See for yourself the many exclusive features which Baldwin has incorporated in Model "C" Compacting Press, *the first press ever designed from scratch specifically for powdered metals.*

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If you are going to miss the metal show, let us send you the booklet on Model "C" . . . prepared specially to give you full description and specifications. Address: Dept. 4616, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.

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MELTING PRACTICE for investment casting

By SAM TOUR*

THE precision investment casting technique is applicable to almost any of the metals and alloys used in the foundry industry. The low melting point alloys such as tin and lead base do not require refractory molds and are not used. The zinc-base alloys also are little used. The alloys usually used fall into three general groups indicated by their pouring temperatures. The pouring temperature required is the determining factor with respect to the type of melting equipment and the type of refractory investment material which must be used. The three groups are (a) Aluminum-Magnesium, (b) Copper-Gold, and (c) Iron-Nickel-Cobalt.

Melting for groups (a) and (b) can be by torch or in fuel-fired or in electric furnaces. For group (c) only electric furnaces or oxy-acetylene torches are usable for melting.

Raw materials

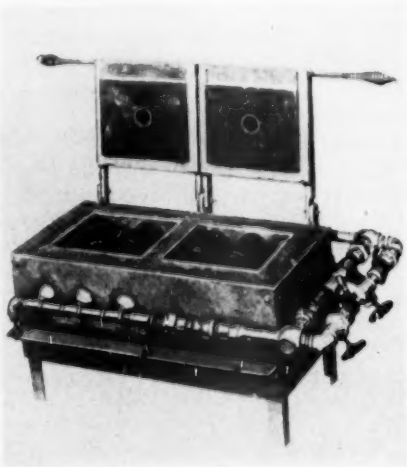
If the alloy is not made up in the shop, ingots of the desired composition may be purchased. When purchasing such ingot metal, the chemical composition limits should not be as broad as the limits on the finished casting because some deviation from ingot metal composition to finished casting is to be expected in spite of all attempts to make proper furnace additions. The use of ingot metal avoids the occasional erratic melts in a foundry due to improper weighing of the many different items which must be weighed up to make up a charge of all virgin metal. Melted under proper conditions and with proper additions or allowances made for

———.

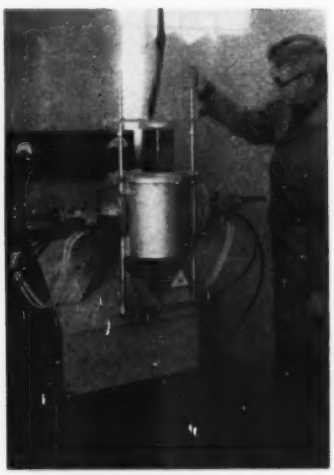
*Sam Tour & Co., Inc.

Representative equipment for melting . . .

1. TYPICAL small gas-fired crucible furnace with swing cover. Courtesy Alexander Saunders & Co.



2. BOX-TYPE gas-fired furnace with two rectangular chambers. Courtesy Alexander Saunders & Co.



3. TYPICAL ELECTRIC furnace, indirect arc type, 10-lb. cap. Courtesy Kuhlman Electric Co.

pickup or burn-out losses and slag losses, there is no reason why repeated melting should in any way harm any of the standard alloys.

Melting losses occur whether virgin metals are melted to produce the desired alloy or whether ingot metals are melted. Often melting losses are higher when making up an alloy from virgin metals than on a second melting of an alloy as is the case in the use of ingot metals. In any event, proper allowance must be made for these melting losses in calculating the charge necessary to be put into a furnace to produce a desired analysis of finished casting.

Every shop desiring to obtain consistently good castings must exercise a complete and unrelaxing control over its raw materials. This requires not only the testing of the raw metals but also the testing of the finished product and an adequate supervision of the precision casting processes. When virgin metals are used, the shop can usually rely upon the chemical analysis as given by a reputable supplier with only an occasional check to see that they are up to the specifications. When ingot alloys are purchased. It is well to specify that the alloy melts as made by the producer of the ingot metal be kept separate and that an analysis be supplied for each melt. An occasional check analysis is also recommended on these ingot metals for both the major elements and the impurities which might be harmful.

Whenever scrap metals are purchased, the foundry certainly should obtain a representative sample and have a proper analysis made of it for both the principal constituents and the impurities. It is only with the proper knowledge of the ingredients in the raw materials that castings can be made which have the specified composition and the desired physical properties.

In the melting room, accurate scales should be provided so that the right weights of the different ingredients are used in the make up of the melt.

Melting equipment

In the melting of alloys for precision casting, the following types of equipment have been and are being successfully used:

1. Crucible furnaces using oil or gas.
2. Indirect arc electric furnaces.
3. High frequency induction electric furnaces.
4. Torches.

In all of these, refractories are, of course, an important item. Refractories will be discussed elsewhere in this article.

In oil or gas-fired crucible furnaces, it is necessary that the air-to-fuel proportion be maintained to produce not only efficient combustion but proper atmosphere in the furnace, uniform heating and proper life of crucibles and furnace linings. The flame should be so directed that it does not inpinge directly upon either crucible or furnace wall and the furnace should be so set that there is ample clearance around the crucible for the passage of the hot gases and uniform heating of the crucible.

Burner tunnels must be so positioned that slag flowing

continued on page 91

4. INDIRECT ARC furnace with mold holding device and hose attachment for pressure, special atmosphere or vacuum. Courtesy Austenal Laboratories, Inc.

5. BATTERY of four tilting type furnaces, 12 KW, set up for efficient operation in a Michigan plant. Courtesy Kuhlman Electric Co.

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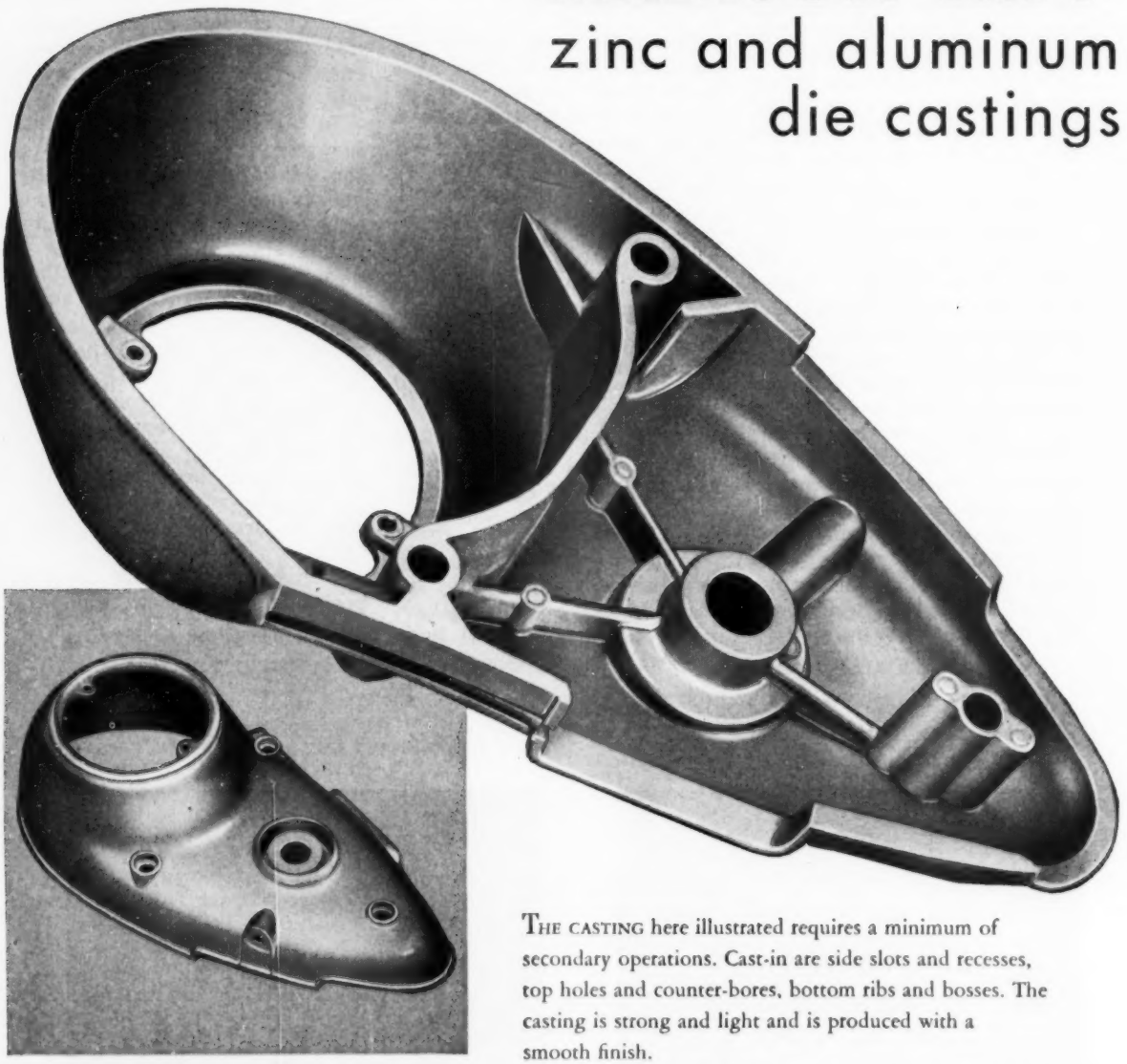

THE CASTING here illustrated requires a minimum of secondary operations. Cast-in are side slots and recesses, top holes and counter-bores, bottom ribs and bosses. The casting is strong and light and is produced with a smooth finish.

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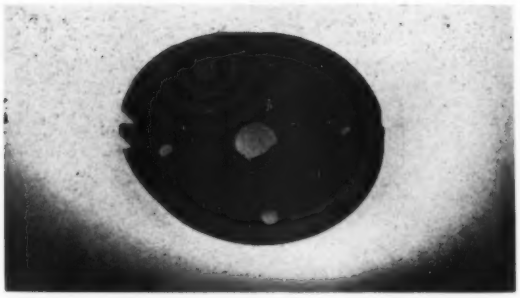

1. PANTOGRAPH duplicating with an end mill was the old method used to produce this piece, now investment cast in aluminum.

2. STAINLESS STEEL is required for these three small pieces formerly machined from wrought stock, now investment cast to save 75 percent.

3. ASSEMBLY of three parts was formerly used for this handle, including two end pieces and a center link. Now it is a one-piece investment casting.

FIFTY-FOLD INCREASE IN THREE YEARS: evidence of acceptance

by WALTER CUSKIE*

THE extent to which the use of investment casting has grown in the instrument field is shown by the experience of the Reeves Instrument Co. of New York. As recently as two or three years ago this company was using only one or two investment castings and these on a highly experimental basis (See PMM, Dec. 1951, pg. 25).

*Sub-contract supervisor, Reeves Instrument Co., New York.

Today this same company uses over 100 different investment castings in a wide variety of metals and whenever possible design specifically for use of this fabricating process.

Of the many investment castings used by Reeves, the following five are highly typical. All of these parts were formerly made by some other method and all of them showed a considerable reduction in manufacturing cost when the change of method of fabrication was made.

Figure 1 is a so-called "gold lead plate" used on gyro equipment. Formerly this complex grooving and slotting was done by end milling with a pantograph type of duplicator. The material is 356 aluminum and is now investment cast in the same material. Some further machining is still neces-

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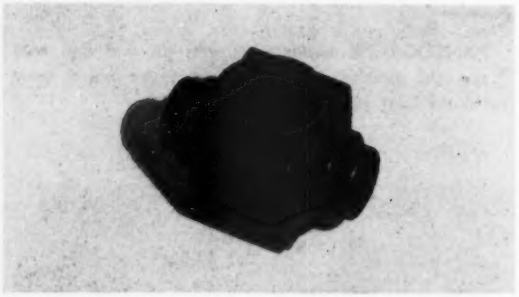
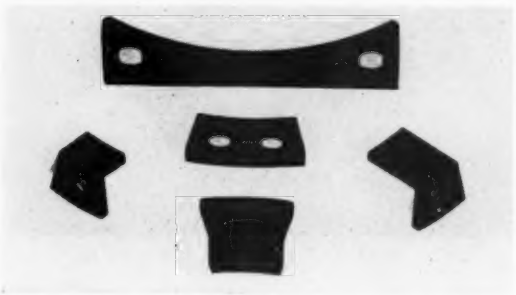


4. FORMERLY CUT from bar stock, this is now investment cast in stainless steel for a marked reduction in cost.



5. SIMPLER IN SHAPE, this variety of motor clamps represent savings of from 40 to 50 percent over machined pieces.

sary to ready the part for use, but even so the change has shown a cost reduction of about 50 percent. The foundry holds most dimensions to ±0.005 tolerances which, for this particular part, is close enough. Since the plate is only lightly stressed, no heat-treatment is necessary. Final surface finishing is by anodizing to give corrosion protection.

There can be no serious objection to machining a part from wrought stock if that is the best and most economical way to make it. The three small pieces shown in Figure 2, however, were initially produced in this manner and it is at once obvious that such a production method would be extremely wasteful of both material and machine time.

These small actuator arm trips are used on an electronic computer and while they are only lightly stressed must be of stainless steel for corrosion resistance and wear resistance. Dimensionally they require the finest quality work of which the investment casting process is capable. Some small amounts of machine work must be done after the castings are received from the foundry, but in spite of this the conversion to investment casting has shown an average saving over machining of 75 percent.

The as-cast finish of the type 304 stainless steel is adequate for use without any further grinding or polishing except in a few critical spots.

Replacing a riveted joint

The computing machine handle shown in Figure 3 is illustrative of how a single investment casting can be used to replace an assembly of two or more pieces.

The original design of this part called for a sand cast aluminum handle with a steel link inserted into a machined slot and held with rivets.

The major objection to the two piece assembly was that the riveted joint invariably loosened after some use. A second objection was the cost of over-all machining of the sand cast aluminum part.

By investment casting the two parts could be produced as a single unit in type 304 stainless steel. No surface machining is required and the riveted joint is, of course, eliminated. The change to stainless steel has also eliminated the need of chromium plating which formerly had to be done. The only surface finishing now done is to bright anneal and barrel tumble.

The change from the two piece assembly to an investment casting has shown an over-all saving of between 50 and 60 percent.

Figure 4 shows another investment casting that has replaced a part formerly machined from bar stock. This so-called differential is another part of an electronic computer and while not ready for use as cast in stainless steel, still shows a marked reduction in manufacturing cost. This same may be said of the motor clamps shown in Figure 5, which are now investment cast instead of being machined from stock. On the differential and the motor clamps there is a cost reduction of from 40 to 50 percent.

While several different foundries supply castings, those described here are made by the Investment Casting Co.

PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating, or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

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Pointed and augur-like, the Central Type "A" Tapping screw pulls and forms thinner (.015" to .050") sheets of metal into a matching threaded section from punched, drilled, or nested holes. Available with slotted, Phillips, clutch or hexagon heads.

TYPE "B" TAPPING SCREWS

Die-pointed and augur-like for thicker metal (.050" to .200"), Central Type "B" Tapping Screws pass through a hole in one piece, form their own threads to lock both parts securely. For porous castings, non-brittle plastics, fibre and asbestos materials.

TYPE "C" TAPPING SCREWS

Recommended for general use in metals from .030" to .100" thickness. Standard pitch thread interchangeable with standard machine screws. Ideal for chip-free assemblies. Second assemblies can be made on projected end of the screw.

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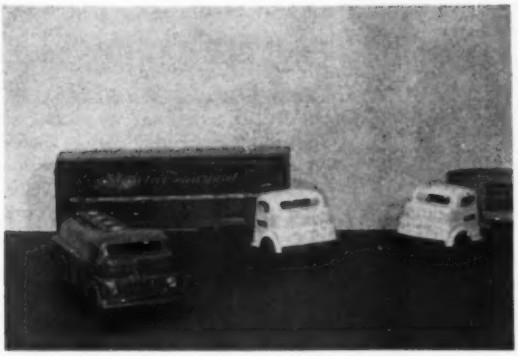

FOR SAFETY, all flash must be removed from edges and openings of the aluminum die castings used in these Structo toy trucks.

LOADING of die cast cabs into the fixtures on the 36-inch diameter auxiliary tables is shown here in closeup view.

INSPECTION of blast cleaned cabs (foreground) makes certain all burrs are removed. Man in picture helps to load and unload baskets of cabs and takes care of minor mechanical difficulties.

DUST COLLECTORS can be seen in this view of abrasive blast operation. The smaller unit is a 1000 cfm capacity collector which serves the abrasive separator, the larger 3000 cfm unit serves the table itself.

Abrasive blasting REMOVES FLASH from die cast toys

STRUCTO Manufacturing Co., Freeport, Ill., America's largest manufacturer of miniature trucks and road building equipment, decided to bring out a new line of toys on which the cab and chassis would be die cast from aluminum and the bodies constructed of steel. This new line would augment their line of miniature trucks and road building equipment.

It was discovered that sharp edges were left around the windows inside and out and on the fenders by the punch press and trimming operations after casting. Since some of the toys weigh several pounds when fully assembled, Structo recognized the possibility of a child lifting a toy and possibly inflicting a cut on his fingers on one of these sharp edges of the cab.

In order to eliminate this hazard, Structo called in engineers of the Pangborn Corp.

continued next page

CHEMICALS ACP PROCESSES

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PAINT BONDING

"GRANODINE"® zinc phosphate coatings improve paint adhesion on steel fabricated units or components—automobile bodies, refrigerators, washing machines, cabinets; and stampings, castings, and forgings.

"LITHOFORM"® zinc phosphate coatings make paint stick to zinc alloy die castings, zinc or cadmium plated sheet or components, hot dip galvanized stock, galvanneal, galvanized signs, siding, roofing, etc.

"ALODINE"® amorphous protective coatings improve paint adhesion and corrosion-resistance on aluminum products—wall tile, signs, aircraft parts, rocket motors, etc.; aluminum strip, aluminum sheet stock, trailers, boats, and other aluminum assemblies and surfaces.

RUST PROOFING

"PERMADINE"® zinc phosphate coatings provide rust- and corrosion-resistance for nuts, bolts, screws, hardware, tools, guns, cartridge clips, architectural items and other steel and iron products.

PROTECTING FRICTION SURFACES

"THERMOIL-GRANODINE"® manganese-iron phosphate coatings provide wear-resistance (anti-galling, safe break-in of friction or rubbing parts) for friction surfaces such as pistons, piston rings, gears, cylinder lines, camshafts, tappets, crankshafts, rocker arms, etc.; and rust proofing for small arms, weapon components, hardware items, etc.

COLD FORMING

"GRANODRAW"® zinc-iron phosphate coatings improve drawing, extrusion, and cold forming operations on blanks and shells, heavy stampings, tubs, tubing for forming or drawing, wire, rod, bumpers, parts to be formed prior to plating or painting.

REMOVING RUST

"DEOXIDINE"® phosphoric acid metal cleaners remove rust, neutralize rust producers, clean chemically and prepare metals for painting.

PICKLING

"RODINE"® pickling acid inhibitors save acid, save metal, and improve pickling operations.

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A solution was found in the installation of an airless blast cleaning table which shot peens the sharp edges on the die cast cabs.

During the time that this 9-foot Rotoblast auxiliary type blast table is operating, it is on a high production basis. At least 1,000 die cast cabs are blasted per hour with the machine operating two shifts a day (16 hours). The unit has six 36-inch diameter auxiliary tables which revolve within the cleaning chamber, so that the abrasive stream strikes every surface of the toy pieces loaded into the fixtures.

Production rate of the table requires two girls to load and unload the fixtures. A man is stationed at the machine to move boxes in and out. When the table was originally placed in operaton a fine abrasive was specified, but since that time heavier grades have been used, with G50 Malleabrasive now being tested in the search for the most effective and economical material.

Efficient dust control is extremely important in the operation of any blast cleaning machine of this type. When the table was installed, a Pangborn 1000 cfm capacity cloth filter dust collector was specified to serve the abrasive separator. A larger 3000 cfm capacity unit type collector was installed to handle dust produced by the table itself.

There were height limitations on the size of collector which could be used in the area in which the blast cleaning table is located. The dual collecting system has proved successful and very efficient.

This installation is a good example of how progressive management uses modern high production machinery to solve manufacturing problems while avoiding the use of expensive hand labor.

OPPORTUNITIES

FOR SALE:—One A.B.C. Die Cast Machine, one pound capacity, used approximately 100 hours. St. Louis Diecasting Corp., 4528 Oleatha Avenue, St. Louis, Missouri

WANTED:—Reed Prentice 1½ die casting machine, Late model either cold or hot chamber. State price and condition. Write Box 10153, Precision Metal Molding Magazine.

WANTED:—Zinc & Aluminum Die Casting Machines in good condition—preferably Kux or equivalent makes. Write Box 10353, Precision Metal Molding Magazine.

DIE CAST ENGINEER:—skilled in all phases of the trade will set up and operate an aluminum or zinc die casting department. Write Box 10253, Precision Metal Molding Magazine.

WANTED—Used compacting presses for powdered metals. 20 ton and upward. Give price, description, etc. Write Box 10453, Precision Metal Molding Magazine.

WANTED—Used batch or conveyor type furnace for sintering bronze and iron parts. Give price, description, etc. Write Box 10553, Precision Metal Molding Magazine.

ALUMINUM INDUSTRY SETS MORE RECORDS

For the second time this year the U. S. aluminum industry has set new quarterly records, Donald M. White, secretary of The Aluminum Association, has announced. "The 623,399,569 pounds of primary aluminum produced in the second quarter was 9 percent over the record first quarter's production," Mr. White said, "and 33 percent over that in the second quarter of 1952."

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NEW PRODUCTS

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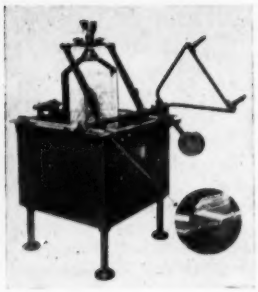

PERMANENT ANODE ROD INSULATION
. . . with new type support

A new type of anode rod support, which provides permanent insulation of anode rods from plating tanks has been developed. It is standard equipment on the new Daniels plating barrels and can be adapted to older installations made by the company.

The newly designed support, in addition to the permanent insulating feature, also offers the advantages of simple replacement and greater current carrying capacity. Permanent insulation is achieved since the support requires no holes and is held in place by a set screw. The back support, which is larger, is adapted for fast, easy connection to a bus bar.

Daniels Plating Barrel & Supply Co.
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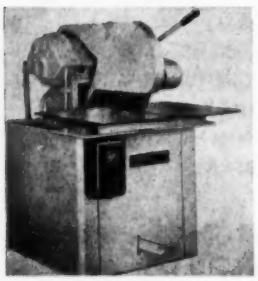

CUT-OFF SAW
. . . for general purpose or foundry

Designed primarily for a chop stroke for cutting off bars and shapes this saw is easily converted for foundry use. A special foundry bed is attached and the head locked in place to ready the saw for removal of gates and risers from castings.

The saws use either 18" or 20" cut-off wheels and the unit is powered by either 7½ or 15 HP motor. For chop stroke cutting a foot actuated V vise holds the stock. Maximum safety is provided by fully guarding the wheel before any cutting starts. High speed and adequate power are said to give cleaner, faster cuts with lower wheel wear and less burning of the stock.

Henry W. Wise Co.
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VERTICAL MILLING MACHINE
. . . for high speed die sinking

Manufactured by the E. H. Jones Machine Tool organization in England, a new vertical milling machine is now available in this country.

The machine is specifically designed for high speed milling and die sinking, the headstock can be swivelled 90 degrees in either direction through a worm and worm wheel arrangement. This device enables the head to be set very accurately and swiftly to any desired angle, and can be re-set to zero extremely rapidly. The machine has a working surface of 32" x 11", and comes equipped with a ¾ H P motor with 8 speeds from 125 to 2960 RPM.

British Industries Corp., International Machinery Div.
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OVAL HEAD BLIND RIVETS

. . . Provide good external appearance

Designed for installations where a finished head appearance is of extreme importance, the new oval-head countersunk drive rivet is offered as a blind fastening to wood or metal.

Oval-head rivets were initially produced for use in attaching moulded plywood to the tubular framework of classroom and institutional furniture. They offer the three-fold advantage of being capable of application from one side of the job, permitting unusual assembly speed, and attaching with a high degree of pull-up exerted in bringing parts together. Installation is with an ordinary hammer.

South Chester Corp.

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MILLING MACHINE VISE

. . . has vibrationless construction

A new milling machine vise, said by the maker to be exceptionally free of vibration, has been put on the market in both 4" and 6" sizes.

Both vises feature a swivel base graduated at a 45 degree angle to the operator for easy reading. Graduations are from 0 to 90 to 0. The movable jaw is secured by means of a slide plate and can be locked solid after the work is clamped in position.

Three hard faced jaw plates are standard equipment, two of them smooth conventional jaws and the third with V-grooves milled in both vertically and horizontally for holding round stock. A short handle for rapid opening and closing and a longer handle, which will not clear the bed plate, for solid locking are furnished with both vises.

Kenco Mfg. Co.

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often IN HALF!

Yes, in less than twenty minutes, you can install a Bellows Drill Press Feed on your standard hand fed Drill Press and cut your cost of drilling holes often in half.

The Bellows Drill Press Feed attaches to the star wheel shaft of the drill press. At a touch of the operating lever, the Feed advances the cutting tool quickly to the work — feeds it into the work at a properly controlled feed rate and thrust — automatically returns the tool to starting position.

You save three ways: rapid advance and retract mean more parts per hour; controlled feeding of tool means fewer rejects, longer tool life; the reduction of operator fatigue means uniformly high production throughout the shift.

Write for this Free Bulletin

Its 16 quick-reading pages tells the story — No cost and no obligation other than to see that the men in your company concerned with **drill press** *production read it. Address: Dept. PMM 1053, The Bellows Co., Akron 9, Ohio.*

In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto 18, Ont.

819-A

The Bellows Co.
AKRON 9, OHIO

For additional information Circle No. 50 on the Reader Service Card

GAS-DRIVEN FLEXIBLE GRINDER . . . works without electricity or air power

For applications such as grinding, rotary filing and other cutting and finishing operations which must be done where neither electricity or compressed air is available, a gasoline engine powered flexible shaft grinder is available.

The new unit consists of a 5 HP gasoline engine with a 7 ft. flexible shaft directly attached to the drive shaft of the motor. The ¾" capacity arbor style hand spindle at the end of the shaft takes any conventional flexible shaft tool and grinding wheels up to 10" x 1½". In addition right angle hand pieces are available. The entire unit is quite mobile. For use as a stationary unit, the hand piece may be securely clamped to the cross bar of the handles, thus providing a fixed bench tool.

Franklin Balmar Corp.
For more information Circle No. 198 on the Reader Service Card

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BENCH MODEL DRILL GRINDER . . . takes ⅛" to 2½" drills

A new model of drill grinder is offered by a company that has long been manufacturing this type of machine. Principle of operation is the same except that this is a single purpose machine and does not have the carbide tool grinding feature that has been included on previous models.

The new grinder has a capacity of from ⅛" to 2½" drills in 2, 3, or 4 lip designs; no change in set-up is required for the entire range. Utilizing no collets or jaws, the operation is said to be so simple that any worker can quickly learn to grind drills correctly and accurately. The grinder has a built in diamond wheel dresser and employs a straight cup wheel.

McDonough Mfg. Co.
For more information Circle No. 199 on the Reader Service Card

VERSATILE COLUMN PRESS . . . adaptable to four different cylinders

One adjustable stand takes air cylinders with either 3" or 4" bore, either single-acting or double-acting. Double acting cylinders can be furnished with any length of stroke up to 36". Single acting cylinders have a maximum stroke of 4"; the return stroke is by internal spring.

Both vertical and radial adjustment of the cylinder can be made. The column is solid steel and the table surfaced, but not hardened.

Mead Specialties Co.
For more information Circle No. 201 on the Reader Service Card

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SMALL POWER PRESS . . . has many big press features

A new 15 ton "unit" power press, of British manufacture, has recently been introduced in this country. The machine is said to introduce a new conception of power press design embodying machine tool mechanical and productive efficiency.

The power unit consists of a complete, self contained assembly of all the press actuating mechanism. The frame is all-steel, welded and annealed to eliminate stresses and the power unit is heavily keyed to the frame, eliminating the use of obstructive frontal bars. An important feature is the total enclosure and submerged oil

continued next page

Backstand Belts save 2 hours per day!

Armour Backstand Belts save 2 full hours per operator per day for steel tube company*

In removing burrs and grip marks from steel tubing, a well-known company* found they saved more than just the two hours per day operators had been given to make set-up wheels. Backstand belts outlast 4 to 5 set-up wheels—and without dressing they remain flat and true. And backstand belts give a better finish, due to their uniform grit.

Belts are only one of the many forms of Armour coated abrasives. There are more than 30,000 different varieties in grit size, backing, etc. We have sheets, discs, rolls, tubes—and specialties to meet your specifications. Your industrial supply distributor will tell you about this complete line. Call him today!

And, today—mail the coupon below for your free copy of our booklet, "How to Store Coated Abrasives." It can help you, too!

*Name of company available on request

We recommend buying through your industrial distributor

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Name..... *Title*.....
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City..... *Zone*... *State*.....
X

For additional information Circle No. 49 on the Reader Service Card

FOR EXTRA BARREL FINISHING SERVICE ...SEE YOUR HONITE DISTRIBUTOR!

Yes, these HONITE distributors are experts —men who offer you *advanced techniques* in every phase of barrel finishing.

Your HONITE distributor will process your samples—determine the exact size HONITE chip and kind of HONITE compound best suited for your needs. He will demonstrate the latest equipment to you. He can do job tumbling for you—by the carton or by the carload. Too, he can train *your* personnel in the best methods of handling barrel finishing equipment and supplies . . . and he has a large warehouse stock of HONITE chips and compound, ready for immediate delivery to you.

So call your HONITE distributor today. He'll show you that low-priced HONITE is the longest-lasting, fastest-cutting natural barrel finishing abrasive on the market. You'll see that no other barrel finishing abrasive—not even granite—retains its cutting edges as long as HONITE!

AUTHORIZED HONITE DISTRIBUTORS
Sales and Service

Micro Deburring Co.
Chicago, Ill.
Mechanical Finishing Co.
Cincinnati, Ohio
Metals Finishing Corp.
Hazel Park, Mich.
Metal Parts Processing Co.
Newark, N. J.
Metal Finish, Inc.
Newark, N. J.
M. E. Baker Co.
Cambridge, Mass.
Tumbling Products, Inc.
Indianapolis, Ind.
Deburrco, Inc.
Philadelphia, Pa.
Gerrell Mfg. Co.
Cleveland, Ohio
Mosher Co.
Chicopee, Mass.
Precision Tumbling & Supplies Co.
Stratford, Conn.
Sundmark Supply Co.
Los Angeles, Calif

Ask about SUPER-HONITE

World's *Toughest* Abrasive Chip

Only chip engineered for *both* grinding and burnishing. Gives high luster finish in jig time because chips never crumble or pulverize.

Minnesota Mining & Mfg. Co., PMM-103, St. Paul 6, Minn.
Yes, I am interested in HONITE Service.
☐ Send me free copy of booklet "3M Barrel Finishing"
☐ I'd like to have a HONITE Sales Engineer call on me
Name.....Title.....
Company.....
Address.....
City.....Zone...State.....

Made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn.—also makers of "Scotch" Brand Pressure-Sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing, "3M" Abrasives, "3M" Adhesives. General Export: 122 E. 42nd St., New York 17, N. Y. In Canada: London, Ont., Can.

For additional information Circle No. 52 on the Reader Service Card

bathing of all load-carrying surfaces.

Other features of the press, which is inclinable, are fingertip control, clutch interlock, built-in work counter, ball-bearing mounted flywheel and oil-immersed multi-jaw clutch. The press is provided with built in safety guards which positively interlock with the press actuating mechanism.

Morey Machinery Co., Inc.
For more information Circle No. 206 on the Reader Service Card

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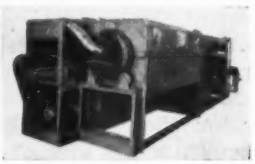
COMBINATION PARTS WASHER
. . . uses rotary drum and flat belt



Designed to remove drawing compounds, cutting oils, grease, and shop dirt from metal parts, this combination machine has both a rotary drum and a flat belt conveyor.

Small parts that can be tumbled are washed, rinsed, and dried in the drum while the tote boxes and larger parts are processed on the conveyor.

Metalwash Machinery Corp.
For more information Circle No. 203 on the Reader Service Card

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GRINDING WHEEL & METHOD
. . . increase life of carbide tools

A new type of grinding wheel and an improved method of grinding are said to increase the life of carbide cutting tools greatly by providing a much finer finish than previously possible.

The sharpening method makes use of a so-called dual wheel: a 120 grit silicon car-

continued on page 82

USEFUL LITERATURE

To receive copies of the publications described here circle key number on reader service card bound in this issue.

PROCESSES

Investment Cast Machine Parts: 144
One of the more recent producers to enter the field on the West Coast, Precision Castparts Corp., has published a 4-page brochure giving highlights of the investment casting process. The publication is well illustrated with shop photographs and typical parts made by the process.

Magnesium Alloy Data Sheet: 145
A compilation of the various magnesium alloys showing the different specification designations for each alloy is included in the August issue of the magazine of Magnesium published by Brooks & Perkins, Inc. Other features of the publication are applications of magnesium castings, plate, forgings, etc.

Sintered Machine Parts & Bearings: 146
A 4-page illustrated pamphlet giving detailed specifications of the complete line of bearings and machine parts made by Powdercraft Corp. has been offered.

Continuous Cast Bronze: 147
Physical properties, tables of available shapes and sizes, weights, photomicrographs and other technical data are included in a catalog available from American Smelting & Refining Co.

Plaster Mold Castings: 148
The "Atlantalloy" process is described and illustrated in a 12-page booklet from Atlantic Casting & Engineering Corp. Also given are tables giving characteristics, properties and suggested uses of metals castable by this process.

Materials That Can Be Investment Cast: No. 149
In a brochure made up almost entirely of photographs of parts, Cadmet Corp. illustrates the range of materials that can be investment cast. Each of the 75 pieces shown in the brochure is labeled with its alloy identification to exemplify the almost unlimited range of ferrous & non-ferrous alloys the company is now casting.

MATERIALS & EQUIPMENT

Stainless Steel Castings: 154
Announcement has been received concerning the development of a new corrosion-resistant alloy of the 18-8 type. Cooper Alloy Foundry Co. has designated the new alloy as V2B. The new alloy is said to be hardenable, not subject to overaging and resistant to seizing and galling. Properties are described in a recent issue of Cooper Alloy Newscast.

Spectro-Chemical Calculator: 155
A new and improved Fan Scale calculator has been announced in a catalog from Jarrell-Ash Co. The calculator is said to speed up spectro-chemical calculations and to give a greater degree of accuracy than heretofore possible.

Beryllium Copper: 156
Applications Unlimited is the title of a new booklet just released by the Beryllium Corp. Typical uses and properties are given in the 15-page booklet which is thoroughly illustrated and indexed.

High Pressure Tube & Pipe Fittings: 157
An illustrated catalog, No. 553, from Flodar Corp. describes and details two lines of high pressure fittings. Engineering specifications, sizes and general information are all included.

Dispersions for Industry: 158
A complete listing of all of the currently available "dag" dispersions has been issued by Acheson Colloids Co. All necessary data concerning these dispersions together with suggested applications are included.

Punches and Dies: 159
How to Save Money on Punches and Dies is the title of a booklet published by the F. J. Stokes Machine Co. The care and maintenance of punches and dies for tablet making machines is thoroughly discussed.

Heat-Resistant Flooring: 160
A heat-resistant flooring designed to withstand thermal shock up to 2000F is described in literature available from Flash-Stone Co., Inc.

Socket-Head Screws: 161
A folder describing some of the manufacturing methods used in making socket-head screws is available from Parker-Kalon Corp.

Hand Pyrometer for Molten Metal Temperature: 162
A new type hand pyrometer which measures temperature on any surface, liquid, gas or molten metal from 0 to 1500F is described in a new bulletin from General Electric Co.

Air and Hydraulic Control Valves: 163
New condensed catalog No. 531 from C. B. Hunt & Son, Inc., describes the company's line of Quick-As-Wink air and hydraulic control valves, valve couplings, etc. Sectional views of body, plunger, packing and interior operation are included.

Die & Mold Polishing & Deburring: 164
Information on die and mold polishing, deburring, blending grind lines, honing of cutting tools & preplate cleaning is contained in a new 8-pg catalog from Cro-Plate Co., Inc. Use of both regular and high velocity wet blasting equipment is described.

continued on next page

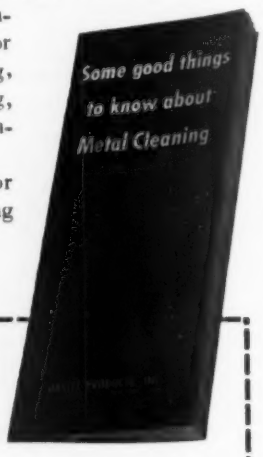
HOW DO YOU PUT A HEAVY PHOSPHATE COATING ON 90 MM. SHELLS?

HOW CAN WE GET BETTER ELECTROCLEANING AT LOWER COST?

These are two of the simplest questions on metal-cleaning we answer every day. Hundreds of tougher ones are asked of the 180 Oakite Technical Service Representatives throughout the country, or come to us through the mail.

We thrive on questions about tank and machine cleaning, electrocleaning, pickling, preparation for painting, paint stripping, steam-detergent cleaning, barrel finishing, rust prevention and related subjects.

There's space below for asking your metal-cleaning question.



OAKITE PRODUCTS, INC.
34G Rector St., New York 6, N. Y.

Tell me (without obligation) about Oakite methods for removing the following soils:

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☐ **ALSO** send me a **FREE** copy of your booklet "*Some good things to know about Metal Cleaning.*"

*Name*_____

*Company*_____

*Address*_____

Technical Service Representatives in Principal Cities of U. S. & Canada

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

For additional information Circle No. 75 on the Reader Service Card

USEFUL LITERATURE — cont.

FINISHING

Industrial Filtration Equipment: 165
A new 8-page brochure by the U. S. Hoffman Machinery Corp. graphically presents the essential features and applications of their 10 basic types of industrial filtration equipment.

Electrical Insulating Joints: 166
A new bulletin describing insulating joints for piping lines to electrolytic plating, cleaning, and anodizing tanks used by the metal working industries has just been released by Barco Mfg. Co.

Wet Blast Cleaning Cabinets: 167
A leaflet is available from Vacu-Blast Co., Inc. which describes their new wet blast cleaning cabinets. The cleaning equipment has no pump and is said to be more efficient than a blast gun.

Plating Anodes: 168
A new 8-page, illustrated catalog published by Federated Metals Div., American Smelting and Refining Co. provides full information on copper, lead, zinc, tin, tin-lead, cadmium, cadmium oxide and brass plating anodes. Sizes, shapes, composition and other data are provided.

Steel Balls and Their Application: 169
A new leaflet containing information on steel balls and their applications is available from Frazar & Co., Inc. Listed are applications for a wide variety of applications such as bearings, valves, pumps, etc.

Platecoil Calculator: 170
A slide rule type of calculator to aid in figuring the number and type of Pletecoils required in a tank installation is now available from Platecoil Div., Tranter Mfg. Co.

Metal Finishing and Processing: 171
A new catalog from Klem Chemicals, Inc. lists 33 standard Klem finishing products and contains a comprehensive application chart for surface preparation of ferrous and non-ferrous metals.

Zinc Phosphate Coatings on Steel: 172
A concise, clear-cut explanation of the problems involved in securing lasting paint adhesion on steel, and in protecting painted surfaces from electrochemical corrosion is contained in a 12-page booklet published by Oakite Products, Inc.

Metal Parts Dryer Replaces Sawdust Tumblers: 173
A new type of Spiral Dryer which dries up to 1600 quarts an hour by means of hot air blast is the subject of literature from Lasalco, Inc. who claim the machine can replace up to 3 sawdust tumblers and 2 or 3 centrifugal dryers.

Plating Room Rectifiers: 174
A brochure is available from the American Rectifier Corp. describing the line of stock units, ranging in size from 3 to 50 KW, made by the company.

Volume Electroplating of Intricate Parts: 175
A descriptive folder has been published by American Electro Products, Inc. describing that company's processes for electrodepositing precise amounts of metal on intricate and close tolerance parts.

NEW PRODUCTS IN BRIEF

126. STAINLESS ALLOY V2B, a new non galling, non-seizing 18-8 type is now being marketed by Cooper Alloy Foundry Co. The new steel is a hardenable type containing copper, molybdenum, silicon and beryllium.

127. UTILIZING A TURNTABLE as a means of conserving floor space, a new parts washing machine has been developed by G. S. Blakeslee & Co.

128. UTILIZING FREQUENCY modulation principles for the control mechanism, Bristol has put a new line of free vane controllers on the market. Temperature ranges available are O-400F and O-3000F.

129. COMBINING THE measuring accuracy of a null balance potentiometer circuit with the sensitivity and speed of an electronic control system, the new pyrometer controller by Thermo Electric Co., Inc. is available in 12 ranges from 0 to 3000F with a variety of different thermocouples.

130. FOR CONTROLLING the temperature of molding platens and similar units a small self-contained control unit is now available from Sterling, Inc. plugged in to a power source and connected to a water and drain line.

131. SPECIALIZING in custom made tools and dies of tungsten carbide, the B. M. S. Carbide Specialties, Inc. The company stocks large quantities of presintered and fully sintered carbide blanks and has the know-how of fabricating and finishing these products.

132. THE NORD DI-PROFILER, an air operated recriprocatng tool specifically designed for work on tungsten carbide is manufactured and marketed by Nord International Corp.

Circle No. 110 on the Reader Service Card

today's "wonder drug" for industry

The greatest cost-saving labor-saving FINISHING DEVELOPMENT in a decade!

SUPERSHEEN SPEED FINISHING does away with costly hand deburring and other expensive hand operations. A single unit replaces from 2 to 12 men. Savings up to 95% on almost ALL types of parts with absolute uniformity, fewer rejects, finer finishes.

Write for NEW FREE 52-Page Catalog

Tells the complete story with latest facts, figures and "before and after" photos.

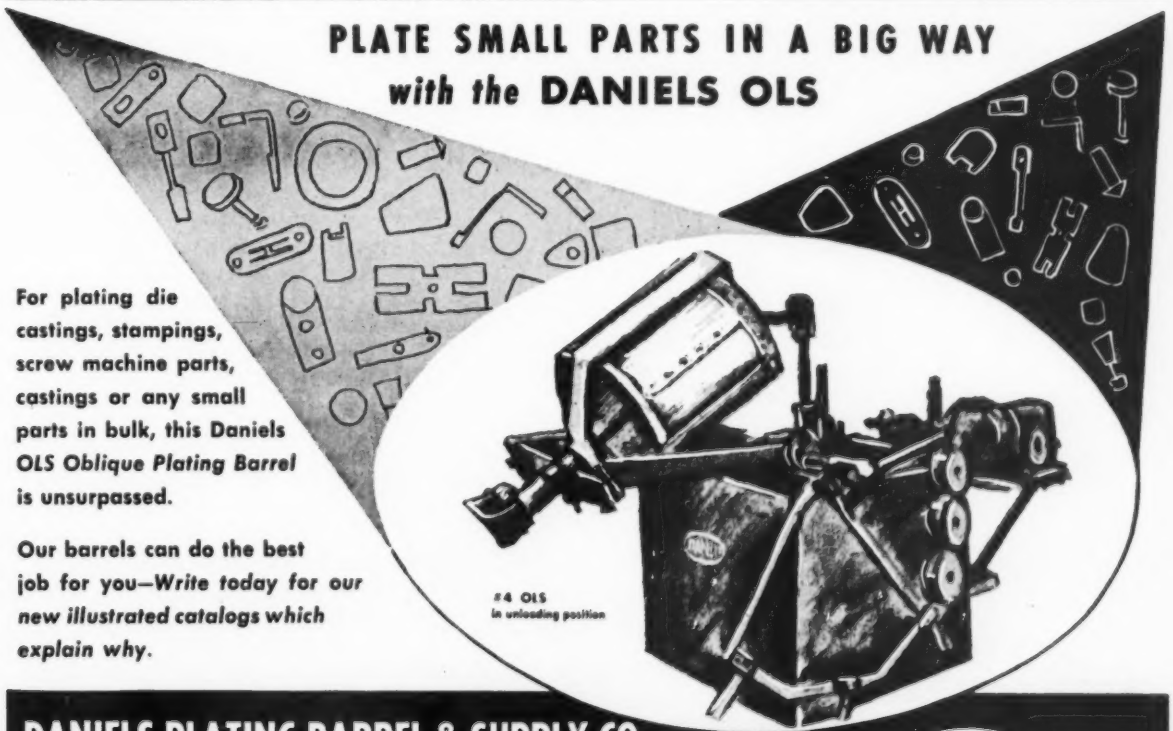
DEPT. D-10

ALMCO Supersheen

AMERICA'S LARGEST MANUFACTURER OF ADVANCED BARREL FINISHING EQUIPMENT - MATERIALS AND COMPOUNDS

ALBERT LEA MINNESOTA

PLATE SMALL PARTS IN A BIG WAY
***with the* DANIELS OLS**



#4 OLS in unloading position

For plating die castings, stampings, screw machine parts, castings or any small parts in bulk, this Daniels *OLS Oblique Plating Barrel* is unsurpassed.

Our barrels can do the best job for you—*Write today for our new illustrated catalogs which explain why.*

DANIELS PLATING BARREL & SUPPLY CO.

MANUFACTURERS and DISTRIBUTORS

Electroplating and Polishing Equipment and Supplies

129 Oliver Street, Newark 5, N. J. • Tel. MArket 3-7450

DANIELS

For additional information Circle No. 73 on the Reader Service Card

NEW PRODUCTS
continued from page 78

bide vitrified bond outer wheel for dry grinding and a phenolic resin diamond lap insert for diamond lapping for a finish. Tests under production conditions indicate that the life of tools, when sharpened by this new method, is increased from three to eight times over that of a normal grind edge. 600 grit diamond is generally preferred for the finishing wheel and measurements on the cutting edge indicate a reduction in surface roughness from 15 to 20 micro inches to 1 or 2 micro inches after lapping.

Penn Scientific Products Co.
For more information Circle No. 204 on the Reader Service Card

INSERT POWER BITS
. . . for production screwdriving.

Introduced only recently, a full range of sizes and types of production bits for power screwdriving is available in production quantities.

The bits are of a special shock resistant tool steel, cold forged and then heat treated to give maximum surface wear. The bits are furnished in two grades one specifically for the aircraft industry and the other for industries where self tapping screws are used. Both grades are made in all size ranges and may be used with existing adapters, either retainer ring or magnetic type.

Zephyr Mfg. Co., Inc.
For more information Circle No. 209 on the Reader Service Card

Here is a new baking type synthetic finish for metal parts that combines unusual clarity with a high degree of chemical resistance.

Product of Maas & Waldstein Co. research, DURACHEM is almost water-white in color—and retains its clarity even after prolonged exposure to heat and sunlight. It also protects metal parts against the effects of salt spray and perspiration.

Typical applications include builders' hardware, vanity and cosmetic cases, lipstick shells and pen caps.

Where decorative color effects are desired on metal, DURACHEM can be supplied in a range of colors with the same chemical stability as the clear finish.

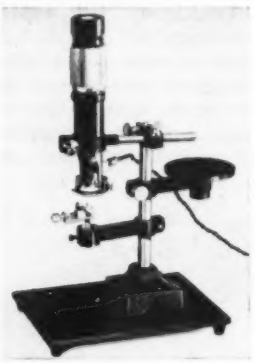
Samples and technical literature are available on request. Or an M & W technical consultant will discuss your requirements privately with you.

OUR 78th YEAR
PIONEERS M&WCo 1876 IN PROTECTION

MAAS & WALDSTEIN CO. 2118 McCARTER HIGHWAY NEWARK 4, NEW JERSEY
Midwest Div., 1658 Carroll Ave., Chicago 12, Ill.
Pacific Coast Div.: Smith-Davis Co., 10751 Venice Blvd., Los Angeles 34, Calif.
MANUFACTURERS OF INDUSTRIAL FINISHES

For additional information Circle No. 74 on the Reader Service Card

MEASURING MICROSCOPE
. . . makes 0.001 linear measurements



A measuring microscope with both 20 and 40 power magnification and a field of 0.580 (at 20X) is now available. At a magnification of 40X the instrument will read directly to 0.001.

Features of the instrument include a swivel mounted work-holding vise, rotating table, built-in illuminator for examination by transmitted or reflected light, detachable base plate, fine focusing adjustment, reticle focusing and precision acromatic lenses, fully corrected for color and spherical abberation.

The microscope is particularly useful in tool and die work and in inspection.

National Instrument Co.
For more information Circle No. 202 on the Reader Service Card

REFERENCE MATERIAL

Catalogs and data offered free in this month's ads; to receive copies circle number on reader service card.

3. WHAT IS MERCASTING? Where can it be used? These and other questions are answered in a bulletin from Alloy Precision Casting Co. devoted to investment casting from frozen mercury patterns.

9. "DIE CASTING ALLOYS — a booklet giving the chemical and physical properties of the Apex Smelting Co. alloys, is being offered.

11. POWDER METAL PRESSES are described in booklet C from the Baldwin-Lima-Hamilton Corp.

12. DIE CASTING MACHINES — a catalog of precision built die casting machines is available from Cast-Master, Inc.

13. 35 POINTS OF SUPERIORITY are described in bulletin no. 400 distributed by The Cleveland Automatic Machine Co. showing their die casting machines.

15. THE GENERAL FACILITIES and services of the Dollin Corp. are described in a brochure now available.

18. PRODUCTION AND RESEARCH facilities of the Hoover Co. die casting div. are described in a booklet "Die Castings".

20. NITROGEN ACCUMULATORS for increased injection speed and a complete line of die casting machines are described in catalog 5106-C from the Hydraulic Press Mfg. Co.

21. NON-FLAMMABLE HYDRAULIC FLUID, its properties, uses and engineering data is the subject of a new booklet by E. F. Houghton & Co.

23. HEAT EXCHANGERS for hydraulic systems are described and illustrated in bulletin 1.1K5 by Kewanee-Ross Corp.

24. DIE CASTING MACHINES by the Kux Machine Co. are described and illustrated in a new folder.

25. ENGINEERING DATA, specifications and applications of Lake Erie Engineering Corp. die casting machines are given in a new catalog.

26. BULLETIN NO. 103 gives the details and specifications of the die casting machines built by Lewis Welding & Engineering Corp.

28. "FILE FACTS" — tells how Monarch Aluminum Co. can do a complete job from casting to finished component.

29. AN ENGINEERING REPORT on Pydraul F-9, a non-flammable hydraulic fluid for die casting machines is available from Monsanto Chemical Co.

34. SPECIFICATIONS AND PROPERTIES of brass and bronze alloys used by Pressco Casting and Mfg. Co. are given in a new bulletin.

35. DESIGN RECOMMENDATIONS typical applications of die castings and the services available from Pressure Castings, Inc. are given in a brochure available from the company.

37. THE INTRICAST PROCESS and examples of Intricast parts are given in booklet MP531 from the Metallurgical Div. of Thompson Products, Inc.

38. HARNESSING HEAT, bulletin B-5459, by Westinghouse Electric Corp. describes heat-treating furnaces of all types.

39. SCREWS FOR DIE CASTINGS, self tapping and thread cutting types are listed in application data sheets from the Central Screw Co.

41. PROPERTIES OF COMPACTS made from pre-alloyed chromium-nickel powders are described in a report available from Metal Hydrides, Inc.

43. BASIC ENGINEERING DESIGN DATA is contained in the book "Dimensioning Die Castings" prepared by Newton-New Haven Co.

44. ILLUSTRATED BROCHURE on the complete services and facilities of the Permanent Mold Die Co., Inc. is now available.

46. BEARINGS AND BUSHINGS, all standard sizes and types carried in stock or which can be made are listed in the Wakefield Bearing Corp. catalog.

47. BRIGHT DECORATIVE AND CORROSION RESISTANT finishes possible with Allied Research Products Co. proprietary materials are described in a general information bulletin.

49. HOW TO STORE COATED ABRASIVES - a booklet by Armour & Co., Coated Abrasives Div. is now available

50. DRILL PRESS FEEDS are described in a sixteen page booklet from the Bellows Co.

continued on page 84

REFERENCE MATERIALS — cont.

continued from page 83

51. DATA SHEETS on bright chromium finish without nickel are available from the Chemical Corp.

52. BARREL FINISHING is the title of a booklet describing super-Honite by Minnesota Mining & Mfg. Co.

53. FINISHING CATALOG describing grinding, deburring, descaling, polishing britehoning or coloring by barrel methods is now available from Roto-Finish Co.

54. BRIGHT HEAT-TREATING methods and equipment are described in literature available from C. I. Hayes, Inc.

56. THE FACILITIES AND SERVICES of the Advance Tool & Die Casting Co. are described in a recently issued bulletin.

59. ADVANCED POWDER METALLURGY is the title of a booklet describing the unusual plant facilities of Dixon Sintaloy, Inc.

NOW.

Sander Discs by CARBORUNDUM

Packaged to save you time and money *on the job* and in the *storeroom!*

Fast-cutting, long-life CARBORUNDUM Brand Sander Discs now bring you extra savings—give you *more for your dollar!* Here are the reasons:

NO BALING TO DAMAGE DISCS
No straps to damage disc edges—or to weaken the fibre by pressure-forcing grain into backing.

MOISTURE RESISTANT SEALED PACKAGE
Maintains proper moisture content in each disc to give you top performance in use. Keeps out excess humidity in transit and storage.

EASIER TO OPEN...EASIER TO STORE
No wire cutters needed. Boxes stack easily and square on shelves or pallets. Why put up with lopsided stacking of bales—with loose unbaled discs—with hard-to-see labels? They all slow down production...waste labor...cost money.

CALL YOUR CARBORUNDUM DISTRIBUTOR or salesman today. He offers a complete line of sander discs for every sanding job. He'll gladly help you select the right combination of discs and sander pads to save time and money on the production line...and in handling and storage. You'll find him listed in the yellow pages under "Abrasives" or "Grinding Wheels." Or, if you prefer, write to The Carborundum Company, Dept. PM 82-325, Niagara Falls, N. Y.

CARBORUNDUM
REGISTERED TRADE MARK

...continually putting more cents in your abrasive dollar!

For additional information Circle No. 72 on the Reader Service Card

61. SMALL DIE CASTINGS weighing half ounce or less are the subject of a brochure from Gries Reproducer Co.

62. CASTABLE ALLOYS prepared by Henning Bros. & Smith, Inc. are described in the Henning Messenger.

66. DESIGN INFORMATION and the facilities of Litemetal Dicast, Inc. are given in a brochure now ready for distribution.

68. HAND AND POWER TOOLS as well as regrinding services are given in a complete catalog from Severance Tool Industries, Inc.

71. SPECIAL SHAPES for barrel finishing are described and illustrated in a catalog from Abbott Ball Co.

73. TECHNICAL INFORMATION and equipment available are all given in a catalog from Daniels Plating Barrel & Supply Co.

74. DATA SHEETS on Durachem, a synthetic water-white lacquer, can be secured from Maas & Waldstein.

75. METAL CLEANING is described in a booklet "Some Good Things to Know about Metal Cleaning" published by Oakite Products, Inc.

76. ENGINEERING DATA on die casting machines is listed in bulletin A-10 of ABC Die Casting Machine Co.

77. THE TYPE OF PARTS produced and the services available from the American Sinterings Div. of American Tool Works are described in a leaflet.

79. ALLOYS FOR INVESTMENT CASTING are described and their properties given in a brochure from the Cannon-Muskegon Co.

continued on page 85

REFERENCE MATERIALS — cont.

continued from page 84

83. OPERATIONAL DATA and detailed information on all types of electric furnaces can be secured from the Harper Electric Furnace Co.

85. ENGINEERS HANDBOOK on powder metallurgy is available from International Powder Metallurgy Co.

86. PLANT FACILITIES and services available are described in a folder from Jersey Plastic & Die Casting Co.

88. HOW TO REDUCE COSTS through the use of stock sizes of bearings and bushings is described in a brochure issued by National Molded Products Co.

90. STAINLESS STEEL LADLES for molten metal, sizes, types and uses are listed in a catalog from Spincrafft, Inc.

92. BARREL POLISHING of zinc and aluminum die castings is described in literature available from Roll Brite Corp.

94. THE INVESTMENT CASTING PROCESS and the facilities of the Adapti Co. are described in a new brochure.

97. ADVANTAGES AND APPLICATIONS of investment casting are detailed in a book available from the Investment Casting Co.

98. ELECTRIC FURNACES for melting high temperature investment casting alloys reported in literature from Detroit Electric Furnace.

99. PROPERTIES AND USES of magnetic iron powders are given in a booklet "Magnetic Iron Powders" published by Magnetic Powders, Inc.

100. JOB STUDY BROCHURE shows analysis of pieces cast in plaster molds by Ohio Precision.

102. DIE CASTING APPLICATIONS, the plant equipment and services of Republic Die Casting Co. are given in a brochure.

106. GRINDER-MILLER tools, high-speed, hand held units are described and types and sizes listed in a Precise Products Corp. catalog.

107. TAPPING HEADS, a catalog of types, sizes, specifications, etc. is available from Procunier Safety Chuck Co.

109. FACILITIES AND SERVICES of the Racine Die Casting Co. are given in a brochure available from the company.

110. MODERN DEBURRING AND FINISHING methods and equipment are described in a 52 page catalog from Almco Div. Queen City Stove Co.

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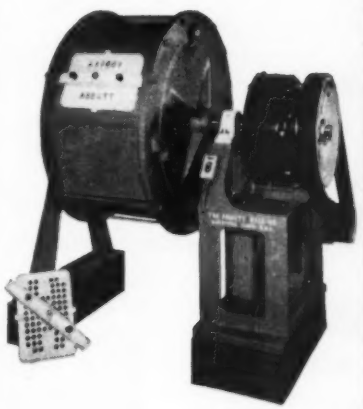

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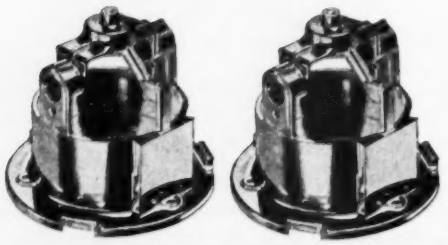

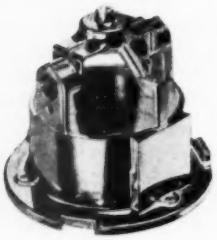

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AMERICAN CHEMICAL PAINT HOLDS 5-DAY MEETINGS

Program for the International Division of the American Chemical Paint Company, Chemical, Agricultural and Chemical Metalworking convention, contained several papers of specific interest to the metal industries. The convention was held Sept. 21-26.

A report on acid cleaning, Deoxidine, Deoxylyte, etc., was given by Alfred Douty; another paper of special interest was one on the alkali cleaning processes given by research chemist Fred Heller. Other subjects covered in the week-long sessions included military and government specifications, phosphate coatings, the painting of metal, development and testing of inhibitors, and many others.

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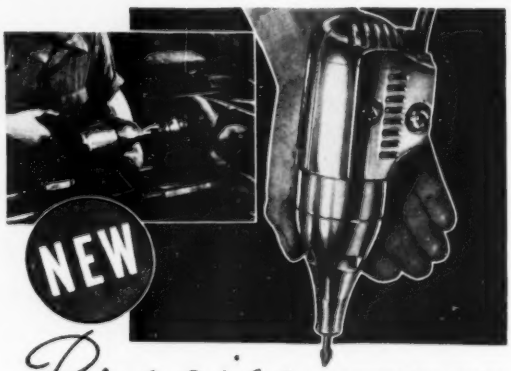

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WAGNER MANUFACTURES FILTERS

Titeflex, Inc., Newark, N. J., announces the sale of the design and manufacturing rights of the industrial filter for electroplating to Wagner Bros., Inc., Detroit, Mich., distributors of filtration and automatic equipment to the electroplating industry. Titeflex still retains the design and manufacturing rights of its filters for the chemical and other industrial applications.

The Titeflex filter features simplified vertical membranes with a unique economical backwash operation. The current filter line ranges from 1 sq. ft. test model to 500 sq. ft. models. Titeflex also does custom design for filtration equipment to the specification of individual customers.

PRINTING PRESS TRACK GUIDES OF CONTINUOUS-CAST BRONZE

Continuous-cast bronze has solved a serious production material problem at American Type Founders, Elizabeth, N. J. ATF uses this bronze in the production of bed track guides for its Little Giant printing presses.

The printing press type bed reciprocates 83.3 times per minute on the guides. Continuous-cast bronze rectangles (75% copper, 5% tin, 20% lead) answer the need for substantial lengths of an easily machined material, somewhat self-lubricating, and with physical properties enabling the guides to stand up under peak loads of 5,000 impressions per hour.

Continuous-cast bronze, made by American Smelting and Refining Company, is said to have superior fatigue characteristics and impact strengths. Since sand, dirt and dross are all excluded from the casting process, there are no inclusions to harm cutting-tools.

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PERMANENT MOLD CASTINGS
continued from page 57

(which amounted to almost 10 percent of the castings) occurred.

With a permanent mold casting not only is there rarely any breakage during machining, but it has been possible to decrease the cross section somewhat. Further, the greater accuracy of the permanent mold casting has decreased the amount of machining that has to be done on the legs to ready them for use.

Other savings in machining have accrued from the change in production methods.

Aside from the lateral holes which have to be drilled and tapped in either case, the only other machine operations that are required are to face one boss (not shown in the illustration) and thread the center hole. As a sand casting these two operations were necessary and in addition the larger center hole had to be bored prior to threading and two other facing operations performed.

On the one base having the toothed adjusting member it was not possible to sand cast the teeth with sufficient accuracy to permit their use. Now they are used as cast.

Surface finishing has also been materially reduced. The foundry grinds off all gates, risers and parting lines; no other surface preparation is done prior to applying a chromate base coat and then lacquering. When sand cast the entire outside surface had to be ground before applying the chromate coat.

Another speaker part that was converted from a sand casting to a die casting is shown in Figure 2. This is a typical tone arm. Previous machining was to turn the entire outside, face both ends, thread the end that enters the base. The three small threaded holes that are located in the bosses presented a considerable problem since concentricity between ID and OD of the sand cast parts varied so greatly, that in many cases the drill broke through either the inner or outer wall when the holes were drilled. The tapered bore of the tone arm also had to be reamed to secure accuracy of shape.

With a permanent mold casting the base end is faced and threaded. The three small holes in the bosses are cored and need only tapping. No other work is done on the casting. The exterior surface is lightly sanded by the foundry to remove flash and the interior surface can be used as-cast.

As noted above, relatively large savings have been achieved through the conversion to permanent mold casting. Without identifying the individual parts, the actual savings that have been made in four different cases are listed in the table.

DOUBLE-CURVED SURFACES FORMED WITHOUT STRESSES BY ELECTROFORMING

In a recent issue of **Inco Nickel Topics** (Vol. 6, No. 3, 1953), published by the International Nickel Company, an interesting discussion of electroforming stresses was presented in the form of a question and answer which is reprinted here.

Q. In the fabrication of certain parts, we often require a number of double curved surfaces to very close tolerances, .002″ in 2″ being not uncommon. Electroforming (nickel) against wax or steel patterns would appear to be a good way to produce these curved parts. But what effect will the internal stresses built up in the deposited metal have upon the final shape? We would expect a certain amount of contraction but is the amount predictable? Would we be able to correct the pattern so that after stress-relief the finished part will be within the tolerance allowable?

On electroformed engine parts which are subjected intermittently to temperatures of 750° or even 1200°F.,—equivalent to a series of annealings—might one expect a steady decrease in tensile strength and hardness, or does it level off at some figure and stay there? —W. P.

A. Most nickel solutions produce deposits that are in tensile stress, the degree of which is dependent upon the type of bath and operating conditions. The all-chloride bath produces a higher stressed deposit than the Watts type bath, therefore some improvement can be achieved by employing the latter solution. To achieve minimum stress in the Watts solution, the following bath composition and operating conditions are recommended;

Nickel sulfate	40-50 oz./gal
Nickel chloride	3-3.5 oz./gal.
Boric acid	5.5-6.0 oz./gal.
Temp.	128-132°F.
Current Density	(normal 30, 75 not critical)
pH	3.0-3.2 (electrometric)

Certain organic addition agents such as nickel benzene disulfonate will reduce tension and actually result in the production of compressive stress. However, the breakdown products of these organic compounds are difficult to control.

continued next page

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ELECTROFORMING — cont.

A nickel sulfamate bath has been recently developed which, it is claimed, enables nickel to be deposited free of stress. This might be suitable for your production.

The deformation of an electroformed part is impossible to predict except by trial and error with a specific unit. Then with close control of all variables, it is possible to reproduce other units, making suitable compensations in the mandrel. We would not expect the deformation effect of internal stress to be as pronounced in units of heavy cross section, since these sections have sufficient physical properties of their own to counteract the internal stresses.

Lacking any specific information to comment in detail on the effect of temperatures of 750° to 1200°F., we would expect the tensile strength of the nickel to level off to about 45/-50,000 p.s.i. after repeated exposure to these temperatures. This level of course would not prevail if oxidation or any other metallurgical phenomena were introduced.

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SHOW MACHINE TOOLS

An international showcase for the metal-working industries opened in Brooklyn, N. Y. when the First International Machine Tool Exposition started there on October 5. It is said to be the first time that such an assemblage of machine tools has been permanently exhibited under one roof.

The Exposition, located at 132-54th St., is a permanent center for the display of American and foreign machine tools.

Sponsored by the S & S Machinery Company, the display includes approximately 1000 tools, including production, toolroom and metal fabricating equipment.

HONOR R. F. MEHL

For the past quarter of a century the work of Robert Franklin Mehl, director of the Metals Research Laboratories and Professor of Metallurgy at Carnegie Institute of Technology, has been viewed with anticipation and appreciation in the fields of industry and education.

For his major contributions to the fields of metallurgy and metallography and for his numerous fruitful investigations leading to obtaining values of theoretical and fundamental importance, The Franklin Insitute of the State of Pennsylvania will award Dr. Mehl the Francis J. Clamer Medal at its formal Medal Day ceremonies, October 21.

APPOINTS REPRESENTATIVE

C. B. Hunt & Son, Inc., Salem, Ohio, manufacturers of Quick-As-Wink air and hydraulic control valves, has announced the appointment of Alfred Halliday, with offices at 317 Starks Bldg., Louisville, Ky., — 1509 Madison Ave., Memphis, Tenn., — and 916½ Henley Ave., Knoxville, Tenn., — as sales representative for Kentucky, Central and Western Tennessee, Northern Mississippi and Arkansas.

MELTING PRACTICE
continued from page 65

from the crucible and from the furnace lining will not build up to the burner tunnel level and interfere with the entrance or direction of the flame from the burner. It is often desirable to set the crucible up on a pedestal so that the bottom of the crucible will be slightly above the burner tunnel level.

The clearance space around the crucible must not be so small that the fuel is not completely burned before leaving the furnace and must not be so large as to result in all of the fuel being burned near the bottom of the furnace causing a hot bottom with a cold top and only spent products of combustion around the upper portion of the crucible and above the metal. This latter condition results in slow melting, short life of crucibles and short life of furnace linings.

The furnace cover should have a properly proportioned central opening as an exit for the products of combustion. Too small an outlet causes a back pressure within the furnace which limits the amount of fuel which can be burned and, therefore slows down the rate of heating, whereas too large an outlet allows the hot gases to escape too rapidly before they have had an opportunity to transfer their heat to the crucible and to the metal.

Figure 1 shows a typical small gas-fired crucible furnace with swing cover and premix blower for mixing the gas with the proper proportion of air.

Figure 2 shows a box type gas-fired furnace with two rectangular chambers for heating up to 4 crucibles simultaneously.

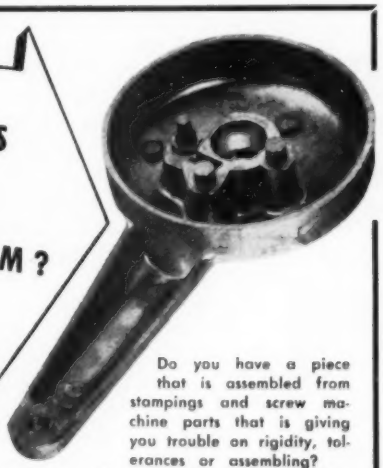
In the precision casting field where small size melts are the rule at the present state of the development of the art, indirect arc furnaces are in production ranging in capacity from two to ten pounds. Neither of these limits is fixed, but the bulk of production comes from melts averaging five pounds.

There are some precautions to be noted with indirect arc melting compared to induction melting which must be considered from a metallurgical viewpoint.

In very low carbon melts, such as stainless steels, there is some carbon pick-up. With good practice this may very from zero to .05 percent. Therefore, to produce castings

continued next page

IS THIS YOUR PROBLEM?



Do you have a piece that is assembled from stampings and screw machine parts that is giving you trouble on rigidity, tolerances or assembling?

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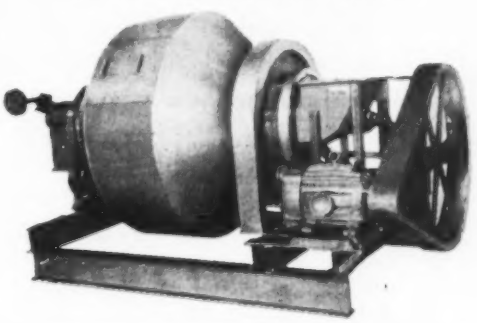

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under .10 percent carbon, it is essential to have melting stock not over .05 percent carbon.

On higher carbon steels, there is a tendency to lose some carbon, although this is probably true also of induction melting. At any rate, with consistent melting practice, this can be allowed for and controlled.

In general, either of the two types of melting equipment lends itself readily to simple remelts of steels and alloys or heats can be made from steel base with alloy additions. With either type of furnace, good melting practice must be followed in regard to deoxidation of melts when working with the simple carbon and low alloy steels, similar to that when steels are made in large production units.

The arc between carbon electrodes in this type of furnace creates an atmosphere high in carbon monoxide which does not allow of any appreciable oxidation of the copper-base alloys. In consuming the oxygen of the air to form this carbon monoxide, this furnace also consumes what oxygen would be available to burn up any oil or grease on turnings or borings which might be charged into the furnace and, therefore, it is necessary in the use of this type of furnace to carefully remove all oil and grease from turnings and borings before melting them in such furnaces.

Oil and grease and moisture on turnings and borings if not removed before being charged into these furnaces develop gases which are absorbed by the metal and give all of the characteristic difficulties. By proper handling of the charge for these furnaces, however, no difficulties need be expected from gassed metal.

Figure 3 shows a typical 10 pound electric furnace of the indirect arc type.

Indirect arc furnaces were applied to precision castings of special corrosion resistant and high temperature alloys for over ten years. One company developed and patented a casting machine using indirect arc melting combined with pressure or centrifugal casting. This equipment was almost universally used in the production of supercharged buckets during the war, and since on gas turbine and jet propulsion blading and general castings of high melting point alloys.

Figure 4 shows the indirect arc furnace with mold holding device and hose attachment for pressure special atmosphere or vacuum.

High frequency induction furnaces are widely used in the precision casting industry. Due to the ease of changing crucibles and the extremely high rates of melting obtainable, these furnaces are very efficient from the time standpoint. They are peculiarly adaptable to the small size melts so common in this industry. Although normally no protective atmosphere is used in this type of melting, it is a simple matter to introduce any type of gas desired under the crucible in a vacuum chamber where vacuum melting is desired.

Torch melting as practised in the precision casting industry is an adaptation from the earlier dental and jewelry casting arts. In place of melting the metal in a furnace and either transferring the crucible full of molten metal to the casting machine or pouring the molten metal into a suitable receptacle at the casting machine, the metal is torch melted in or adjacent to the pouring basin of the mold.

For low melting point metals, city gas-air torches can be used. For metals with intermediate melting points city gas-oxygen torches can be used. For metals with high

continued next page

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A pioneer in its field, Milwaukee offers you the experience and knowledge gained in helping others for more than 40 years, to realize the full benefits of the die casting process. In its modern plant, it offers you the most advanced facilities for the production of zinc and aluminum die castings. These extra values which cost you no more, can help you build extra values into your product, too.

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melting points, oxy-acetylene torches are used.

Where the amount of metal to be melted for each mold exceeds 2 ounces, it is usual to use a melting vessel or crucible adjacent to the pouring basin of the mold as mounted on the casting machine. For increasd efficiency, it is common to preheat the vessel or crucible in a furnace of some sort before setting it in place for melting.

In torch melting, which is a purely manual operation, the skill of the operator is all-important. The proportions of fuel to oxygen used in the torch, the position of the torch tip with respect to the melting vessel, the motion of the flame during melting, the judging of final temperature are all within the control of the operator.

Editor's Note: Part Two of Mr. Tour's article will appear in the November issue of PMM. It will present information on melting contamination, melting losses, and melting temperatures.

INDIANA STEEL GETS RESEARCH CONTRACT

The Indiana Steel Products Co., Valparaiso, Ind., world's largest producer of permanent magnets, has been selected by the U. S. Air Force for a contract sponsored by the Wright Air Development Center of the Air Research and Development Command to conduct a comprehensive research program on magnetics, to improve military air and ground devices utilizing magnets, it was announced today by Air Force and company officials.

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In the investment casting industry gates and risers may account for as much as 50% of the total casting weight. You lose money every time you sell as scrap the alloys lost in the gates and risers.

When you deal with **CANNON-MUSKEGON** you can return this "scrap" for re-alloying and remelting into fully certified master melting metals such as tool steel, stainless steel, super stainless steel and alloys built exactly to your specifications.

Write **CANNON-MUSKEGON** for a brochure covering our facilities or for an actual sample of our product.

MASTER MET

CANNON MUSKEGON
Muskegon, Michigan, U.S.A.
Tailor Made Alloys for the Investment Casting Industry

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INDUSTRY NEWS

LARGEST TESTING MACHINE TO TO BE BUILT BY BALDWIN-LIMA-HAMILTON

An order for the largest universal testing machine ever built has been placed with Baldwin-Lima-Hamilton Corp., Philadelphia, Pa. The new hydraulic machine has been ordered by Lehigh University, Bethlehem, Pa., for delivery not later than February 1955.

Although the machine will be the third testing machine of 5,000,000 lb. capacity built by Baldwin for tests in tension, compression, and flexture, its height of 57 feet is eight feet more than the next largest and 10 feet more than the first machine of this capacity.

Clear space in the machine for test in either tension or compression is 40 ft. vertically and 10 ft. between columns. Structural provisions for transverse testing are to be built into and under the laboratory floor.

RANSOM & RANDOLPH OPENS PLANT IN L. A.

The Ransom & Randolph Company, major producer of industrial investments for investment casting, and dental gypsum products, has recently started production in a new plant located in the Central Manufacturing District of Los Angeles.

This plant brings to the west coast a new source of investment materials and dental stones which formerly had to be shipped from the east.

The plant is located at 2337 Yates Street, in a newly developed manufacturing section. It is of modern one story design and contains more than 12,000 square feet of production area. The floor height is truck and railway car level, with ample facilities for freight cars and trucks both incoming and outgoing.

Plant material handling and compounding equipment is of the latest modern design, which makes possible both a larger capacity and improved uniformity of product. The chemical and physical laboratory control facilities include all necessary modern equipment to assure rigid production control.

CLEVELAND HARDWARE DIE CASTING UNIT HAS NEW SALES HEAD

The Cleveland Hardware and Forging Company, Cleveland, Ohio, has announced

Arthur E. Hills

that effective September 1st, Arthur E. Hills has been appointd sales manager of the Die Casting Division.

Mr. Hills' experience in design and development for both zinc and aluminum die castings brings to this new position experience and knowledge obtained over the past 23 years, the last nine of which were spent in the die casting field.

ALUMINUM FOUNDRY DOUBLES FLOOR AREA

Floor area of the Yellow Springs, Ohio, plant of Morris Bean and Company's Antioch process aluminum foundry will be brought to 88,000 square feet by a new addition now under construction. The new area will be in full production by January, 1954.

Maximum productive capacity will be upped by 60 percent and will require about 100 new employees to maintain projected operating schedules.

The Yellow Springs plant specializes in aluminum cast-

ings made by the "Antioch Process" developed by Morris Bean in the years between 1930 and 1936. The present plant was completed in 1951.

Simultaneously with the plant addition in Yellow Springs, several steps are being undertaken to increase the capacity of the Morris Bean & Company ductile iron foundry in Cedarville, Ohio. New electric furnaces for melting iron were installed in August. By the first of the year, it is anticipated that the production of the iron foundry will be four times the current level.

NEW SALES REPS

Appointment of Industrial Products Sales, Inc., as field sales engineers for the states of Ohio and Michigan is announced by S. E. Flenner, sales manager of Alloy Precision Castings Company, Cleveland.

Company headquarters are at 227 W. Exchange St., Akron. Branch offices are maintained at 238 W. Lafayette St., Dayton, and in the Fisher Bldg., Detroit.

Industrial Products Sales, Inc., originally established in 1947, handles castings, forgings, stampings, fasteners, and welded steel tubing.

ST. LOUIS DIE CASTING HAS NEW OFFICERS

Announcement by St. Louis Die Casting Corp., 4528 Oleatha Ave., St. Louis 16, Mo. of the corporation's new officers has just been made. Roger C. Shirtum, is now president; Emil Labanics, vice president; George Krieger, second vice president; and Edgar Kramer, secretary and treasurer.

PAUL BERNDT QUITS INDIANA DIE CASTINGS

The board of directors of Indiana Die Castings, Inc. Elwood, Ind. has accepted the resignation of Paul E. Berndt, Jr. as director, vice-president, and general manager effective August 31, 1953.

E. W. Montgomery, special assistant to the president of C. M. Hall Lamp Co. in Detroit, and formerly assistant director of purchases, Packard Motor Car Co., will temporarily assume the duties of general manager until suitable permanent replacement is announced.

G. N. Fitzgerald, formerly with Corcoran-Brown Lamp Div. of the Electric Auto-Lite Corp. in Cincinnati, Ohio has been named plant superintendent, temporarily replacing H. J. Mallory who also has left the company.

The company announces the completion of its plant expansion program this year which added approximately 40,000 square feet with much new equipment.

"Cleveland"
Die Castings
of Zinc or Aluminum

Avoid lost-time costs at point of assembly. "Cleveland" die castings, precision-made to your blueprints, fit right the first time, without forcing or extra machining.

Member of "The Certified Zinc Alloy Plan"

Prompt quotations... closest attention given to your delivery requirements

THE CLEVELAND HARDWARE AND FORGING COMPANY
3256 East 79th Street, Cleveland 4, Ohio
Our 72nd Year of Business

For additional information Circle No. 58 on the Reader Service Card

POWDERCRAFT NAMES KINNEY OHIO REP

H. L. Kinney, better known as Les Kinney, has been appointed Ohio's exclusive representative for The Powdercraft Corporation of Spartanburg S. C. Powdercraft are fabricators of sintered powdered metal parts and self lubricating bearings.

Les Kinney

Mr. Kinney is one of the pioneers in the field of sintered metal powder. He was associated with the S. K. Wellman Co. for 22 years in various sales capacities. In 1947 he was elected executive vice president of The Wel-Met Co. which position he held until that company was sold. For the past year he has become a manufacturer's representative covering the state of Ohio.

NEW POWDER METAL DIVISION SET UP

American Tool Works of Hartford, Inc., has announced the formation of American Sinterings, a division created to experiment, design and manufacture in the field of powder metallurgy.

American Sinterings, with an experienced staff, is already in full scale production of electrical and mechanical components using latest type equipment. The new division, located at 132 Allyn St. in Hartford, Conn., is equipped to handle basic engineering and every phase of production including tooling and machining of parts.

Improve Your INVESTMENT CASTING Results!

☆

Let us help you solve your investment casting problems.

☆

Time-tested Ransom & Randolph Investments can save you time and money in the production of consistently accurate castings. They are backed by nearly half a century of leadership in the manufacture of dental casting investments, and more than twelve years of experience in producing investments for casting all low- and high-melting alloys used in the industrial field.

THE RANSOM & RANDOLPH CO.
TOLEDO 1, OHIO
Established 1872 • Known the world over for products of highest quality

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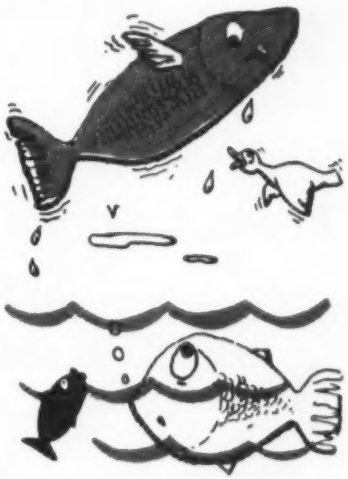
many parts are like fish out of water . . .



look to "sinterings"
(POWDER METALLURGY)

the better method for fabricating small complicated parts.

- HIGH PRODUCTION ECONOMY
- INTRICATE CONTOURS
- METALLURGICAL CONSISTENCY
- FERROUS OR NON-FERROUS
- CONTROLLED POROSITY
- ALL SURFACE FINISHES
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write today for your copy of our new informative brochure or for a representative to call.

American Sinterings

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En Garde!

Safeguard Your Product From Cost Competition — Specify ALUMINUM and MAGNESIUM Die Castings

ALUMINUM POWER SAW GUIDE

Recently LITEMETAL Engineers were called upon to produce the aluminum Saw Guard illustrated here. They developed the dies for casting this important protector of users' fingers for Sears Roebuck's new Craftsman 10" Power Saw. Besides the Guard, 5 other aluminum parts are die cast by Litemetal for this tool, which is manufactured for Sears by the Central Specialties Division of King-Seeley Corp. An aluminum die casting such as this Saw Guard is low in cost, light in weight, yet tough and durable. It not only helps reduce the product's weight but virtually eliminates machining, finishing and assembling . . . effecting savings in time and labor that play an important part in holding down the selling price of the finished product. Another advantage is the greater freedom and scope offered designers by the new lightweight aluminum and magnesium alloys.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST, Inc.

A DIVISION OF HAYES INDUSTRIES

1925 WILDWOOD AVE · JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

For additional information Circle No. 68 on the Reader Service Card

INSTRUMENT HOUSINGS
continued from page 43

has consistently held somewhat closer dimensions.

The motor housing shown in Figure 2 is also investment cast by International Nickel Co. On this piece, thin sections and complex shape are not as notable as on the gimbal, but the soundness of the casting and the precision of manufacture are just as great.

For this part, other methods of manufacture could be used readily, but investment casting has proven to be the most economical.

Both of the castings described are in SAE 8620 steel, annealed at 1300F prior to any machining and normalized at 1600F after machining. Corrosion resistance is, of course, important and for that reason the parts are given a black oxide surface finish. On these two parts there are some surfaces where both finish and accuracy are so critical that the final machining, in this case lapping, is done after the parts have been given the black oxide surface treatment.

2. MOTOR HOUSING for a gyro mechanism, investment cast to provide thinner walls, more complex coring, and greater initial accuracy. Tooling costs and the cost of jigs and fixtures are all lowered by the use of an investment casting.

POWDER METALLURGY DEVELOPMENTS REPORTED IN MPA PROCEEDINGS

Proceedings of the Ninth Annual Meeting of the Metal Powder Association, which took place in Cleveland, Ohio, on April 21 and 22, 1953, have just been released. In the form of a 111-page leatherite bound booklet, the Proceedings include all papers, illustrations and discussion of the papers presented

at the meeting and provide a commentary on the latest developments in powder metallurgy.

Papers included are:

"Progress Report on the N. B. S. Permeameter," by G. P. McKnight; "Design Trends of Powdered Iron Core Inductances as Used in the Electronics Industry," by Bernard Goldsmith; "The Processing, in the Higher Density Range, of Durable, Precision Iron Powder Parts on a production Basis," by William J. Doelker and Harold T. Harrison;

"Metal Powder Friction Materials in Heavy Duty Transmissions," by J. E. Storer; "A Survey of Iron Powder Production Capacity," by Robert L. Ziegfeld and David M. Borcina; "Powder Metallurgy at the Cross Roads — Present and Future Possibilities," by John D. Shaw and Walter V. Knopp.

"A Progress Report on Brass," by D. C. Bradley and W. R. Toeplitz; "Non-Metallic Impregnation of Sinterings," by Wilson N. Pratt; "Review of Aluminum Powder Metallurgy," by J. B. Haertlein and J. F. Sachse;

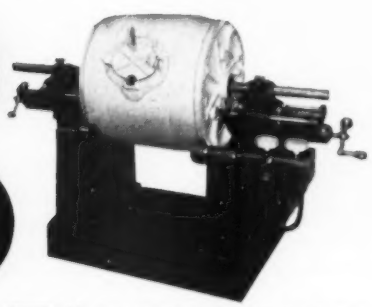
"Alloy Powders by the Hydride Process," by B. A. Gruber; "The Metal Situation," by Dr. Joseph Zimmerman.

Copies of the Proceedings are available for $2.50 each from the Metal Powder Association, 420 Lexington Avenue, New York 17, New York.

All the refinements of its big brothers!

Type GMS

60 lb. 30 kw.



DETROIT ROCKING ELECTRIC FURNACE

This compact, efficient 60-lb. furnace has all the features of the famous, large capacity Detroit Electric Furnaces that melt metal for world famous products. Type GMS produces uniform, high quality melts with efficient and economical use of power. It's excellent for limited production, and for experimental and educational use. New rocking controller, 3-phase motor and independently-mounted electrode brackets are new features . . . Sold complete with transformer. Write for information.

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KUHLMAN ELECTRIC COMPANY
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Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D. F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.

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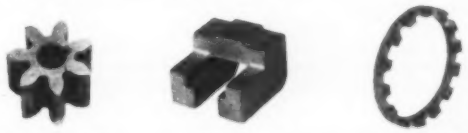
For additional information Circle No. 101 on the Reader Service Card

MACHINE PARTS and BEARINGS *by Powder Metallurgy*

SELF-LUBRICATING BEARINGS:

Standard sizes as described in Metal Powder Association Standard No. 14-51T on (Metal Powder Sintered Bearings). Also special bearings. Write for complete information.

METAL POWDER MACHINE PARTS:



AUTOMOTIVE TEXTILE AIRCRAFT

Above are just three of the many types of metal powder machine parts we manufacture. Also manufacturing metallic friction materials and filters.

Metal powder machine parts can be purchased under several government and industry specifications. These include MIL-B-5687-A, MPA 16-52T and ASTM B-202-45T.

If you are reviewing costs on existing parts or estimating on new construction and will send us your prints, our engineers will:

(1) Furnish you with quotations if the part is adapted to our method of manufacture.

(2) Suggest possible modification in design to effect further economies.

(3) If the part is not feasible in metal powder suggest other practical methods of manufacture.

Powdercraft Corp.
750 Hayne Street
Spartanburg South Carolina

PRODUCTION COST CUT 52%

by Investment Casting

INVESTMENT CAST
In Aluminum but could be cast in bronze or steel.
2 Slots cost to .063
4 curved Slots cost to .093

Formerly milled from bar stock, this Electronic Part is now INVESTMENT CAST for the Reeves Instrument Co. Set-up machine time and scrap loss are reduced considerably.

You should investigate the savings INVESTMENT CASTING offers not alone over machining methods but other casting methods when secondary operations are necessary. Short runs can be produced economically by INVESTMENT CASTING, since mold costs generally are lower. Send for free booklet "INVESTMENT CASTING—A Guide to its Advantages and Applications"

For estimates send sample parts or prints.

INVESTMENT CASTING CO.

321 CHESTNUT ST. NEWARK 5, N. J.

Precision Castings in Any Castable Alloy

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PROMOTIONS AND APPOINTMENTS

Appointment of CLEM W. KOHLMAN as advertising manager of the Industrial Chemicals Div. of *American Cyanamid Co.*, has been announced by RICHARD E. SUMNER, general manager of the divison.

Cowles Chemical Co. announces the appointment of CLAY A. SAYERS as technical man in the metal cleaner department for the sales territory of southern Ohio, Indiana and Kentucky.

Now Available

SWEDISH SPONGE IRON POWDER from a DOMESTIC SOURCE

With the completion of our new powder-making facilities in the United States, we are in a position to supply your needs for high quality sponge iron powder.

This is not "just another plant" for producing iron powder, but features the newest and best equipment available for quality control. Our modern laboratory facilities assure constant and dependable control of powder quality, identical in physical and chemical properties from shipment to shipment.

HOEGANAES SPONGE IRON CO.
545 Fifth Ave., New York 17, N. Y.

Distributed By
EKSTRAND & THOLAND, INC.
441 LEXINGTON AVE.
NEW YORK 17, N. Y.

For additional information Circle No. 64 on the Reader Service Card

The board of directors of *Oakite Products, Inc.* has announced three changes in the managemtnt of the organization. J. J. BASCH a 28-year veteran with the company was appointed manager of research and product development; E. H. STEIF, general attorney for the company, was made assistant secretary and elected to the board of directors; W. A. BALTZELL is the new assistant sales manager.

Rudolph B. Flershem, president of *Buffalo-Eclipse Corp.* has announced the election of ROBERT E. DILLON, president of *Lake Erie Engineering Corp.*, as a director of the Buffalo-Eclipse Corp.

PATRICK H. NORTON has joined the sales engineering staff of *Frederic B. Stevens, Inc.* He will cover the western Michigan territory with headquarters in Grand Rapids.

Reed-Prentice Corp. of Worcester, Mass., has announced the appointment of JEROLD L. WELCH as chief engineer.

G. W. BALLANTINE has been appointed to the newly created position of manager of the *Coated Abrasives Dept, of Armour & Co., Alliance Div.*, Alliance, Ohio.

General Electric Co. has announced the appointment of ROBERT M. PARKE as manager of the materials and processes section of the metallurgical research department.

Acheson Colloids Co. has named JAMES R. WARD, research technician and WALTER D. JANSSENS, research assistant, according to an announcement by Dr. H. J. Dawe, technical director of the company.

The *Wagner Brothers Equipment Co.* announces the election of JOHN D. TABBEN as president and chairman of the board.

JOHN J. STOBIE, JR., sales engineer in the Chicago plant of *Apex Smelting Co.*, has been transferred to the company's new Los Angeles plant in a similar capacity.

THEODORE C. SMOLINSKI, has been appointed director of technical service for *Wagner Brothers, Inc.*, electroplating warehouse suppliers and manufacturers.

Five promotions in the Brush Div. of the *Osborn Mfg. Co.* have been announced by E. V. Dowden, manager of the division. GEORGE R. LUNDBERG, formerly assistant sales manager has been promoted to sales manager; FREDERICK T. TURNER, formerly assistant sales manager, has been named manager, market research; EVERETT A. SISSON, formerly sales project supervisor, has been made assistant sales manager; ALFRED J. CHANGLER, formerly assistant manager, industrial sales, is now manager, industrial sales; C. A. DOLBY, formerly advertising and sales promotion manager has been promoted to manager, distributor sales.

G. I. BRADFORD has been appointed vice president and director of operations, and W. E. GREGG has been appointed assistant director of operations of *Rem-Cru Titanium, Inc.*, producer of titanium metal, jointly owned by *Remington Arms Co., Inc.*, and *Crucible Steel Co. of America.*

Precision Castparts Corp. has announced the appointment of DON GJESDAHL as sales representative for the Pacific Northwest territory.

JOHN M. DOLAN, vice president and general sales manager of the *Hydraulic Press Mfg. Co.*, announces the appointment of DEAN M. COCHRAN as assistant sales manager. Cochran will also be manager of metalworking and process press sales div.

Metal Hydrides, Inc. has announced two personel changes. ROBERT C. WADE becomes assistant director of the chemical research laboratory and ROBERT D. GRAY moves from superintendent of the chemical division to factory superintendent.

Bone Engineering Corp. has appointed EDWARD G. MACLENNAN as sales manager.

Aluminum Co. of America has announced two recent appointments. DONALD I. BOHN, formerly chief electrical engineer will head special electrical development engineering work; LOUIS N. GRIER, formerly assistant chief electrical engineer, is chief electrical engineer.

continued on page 124

HOEGANAES

Sponge Iron Powder

Part of the new sponge iron plant at Riverton, N. J.

Call in Your
Powder Metallurgy Fabricator
For Design Consultation

EKSTRAND & THOLAND, INC.
441 LEXINGTON AVENUE
NEW YORK 17, NEW YORK

Sellers of Hoeganaes sponge iron powder.

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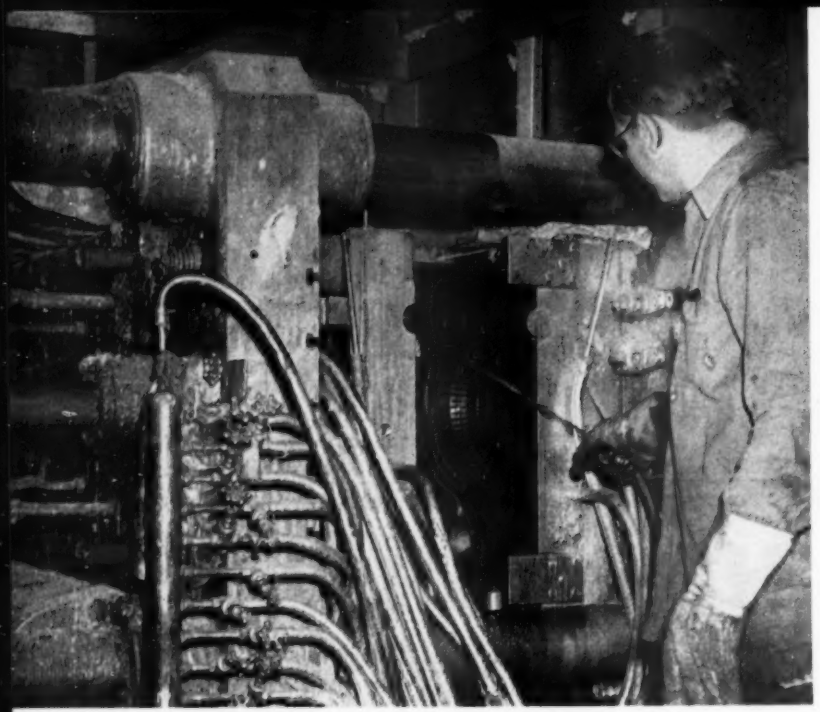

LUBRICATING a large die cavity with a blow-pipe dipped in Die Slick.

Die Lubricants: Part Two

By V. W. SMITH*

THE origin of die casting, defined as pouring molten metal into a reusable metallic mold, is not recorded in history. The first **pressure** die casting machine on which illustrated records are available was patented by J. J. Sturgis in 1849. By 1910 pneumatically operated die casting machines were in use, and the industry was beginning to "grow up" in every respect. Now, die casting is one of the most economical methods of obtaining metal shapes, and a method where tolerances of ± 0.005 are met as a matter of daily routine.

Standardization of alloys and die design factors; better control of casting temperatures and conditions; better metallurgy; and a growing understanding of die lubricant problems are rapidly obsoleting the former success factor of individual "art" on the part of the casting machine operator.

*G. W. Smith and Sons, Inc.

Functions of die casting die lubricants

Die casting die lubricants should perform these main functions:

1. Prevent wear and galling of die parts.
2. Eliminate sticking of castings in dies.
3. Insure easy ejection of castings.
4. Act as cooling agents on die surfaces.

5. Reduce surface tension for better metal flow and easier fill-out of the casting.

6. Protect die surfaces from erosion by the inrush of the casting alloy.

7. Prevent welding of molten casting alloy to die cavity surfaces.

8. Act, to some extent, as an insulator to prevent too rapid chilling of the casting alloy.

Although not strictly functions, other desirable characteristics of good die lubricants are:

1. That they be non-toxic,

2. That they not generate odors or smoke,

3. That they be chemically stable and uniform,

4. That they not "attack" dies or machine parts,

5. That they be "non-staining" where plateability of casting is a requirement,

6. That they not cause a residual build-up in the dies,

7. That they help "cure" dies for better, and cleaner operation.

Why one lubricant can't do everything

The primary reason why no one lubricant can cover all requirements is the variety of temperatures under which it would have to work. The metals and their alloys regularly cast today have melting points ranging upward from 309F. for lead to as high as 1950F. for some of the alloys of brass.

It is not necessarily true that a lubricant right for high temperature alloys will be successful when used in casting low temperature alloys. For example, a grood brass or aluminum die casting lubricant will not be consumed rapidly enough at the relatively low casting temperature of zinc, and conversely, a specific lubricant for zinc will be consumed too rapidly to be fully effective when used on aluminum or brass castings.

The first report on die lubricants published in PMM, May 1953, was devoted to silicone lubricants. This article discusses a group of six proprietary compounds. An article scheduled for future presentation will cover colloidal graphite lubricants.

Six distinct lubricants are discussed below with regard to the considerations outlined above.

The "parent" or base of this group of lubricants is a modifiable viscous compound that will not readily deteriorate under heat or friction, and one that remains stable in any of its variant combinations.

From this "parent" product, six separate compounds have been developed, each with specific applications, according to individual circumstances. Here is a brief description of

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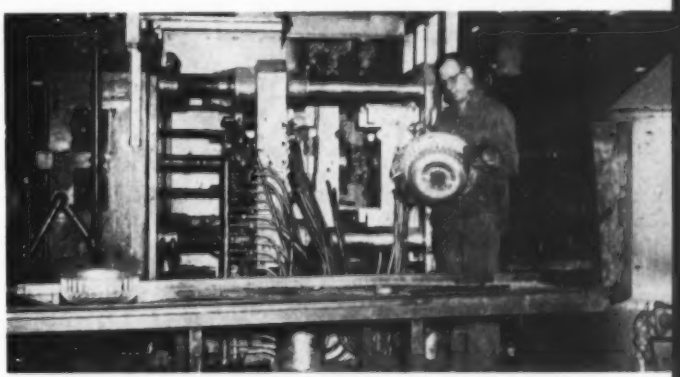

GOOD DIE LUBRICATION is essential in producing this 15-pound aluminum casting for an automatic transmission. All photos courtesy The Electric Auto-Lite Company.

STICKING and scoring of the plunger on this cold chamber machine is prevented by use of special PS plunger lubricant.

the particular character of each variant[1].

• • •

Type 3: For difficult aluminum and magnesium castings.

Character: Very heavy, viscous concentrate, silvery in color, stain-free on aluminum or magnesium castings.

Action: Imparts a microscopic silvery coating that aids parting and ejection, enables better metal flow and better fill-out of castings. Specifically for extremely difficult castings.

• • •

Type 4: For casting brass alloys.

Character: Extra heavy-duty type compound with some micronized graphite for use in casting brass alloys. Sometimes used on ejectors, and guide pins when casting aluminum or magnesium.

Action: Has high heat resisting qualities, with good lubricity under high temperatures. Applied full strength where lubrication of sliding parts at elevated temperature is required.

• • •

Type 9: For zinc castings that are to be plated.

Character: A non-staining, light colored compound.

Action: Prevents staining, assures maintenance of clean cavities, cores, ejector pins and guide pins.

• • •

Type 11: For general zinc casting.

Character: Slightly amber, high-viscosity fluid that is generally stain-free unless applied too heavily. For general use with zinc.

Action: A heavier duty compound than No. 9, this compound is intended for use where lubricity requirements are severe, to prevent sticking or scoring.

• • •

Type SG: For all types of castings.

Character: A high-viscosity amber fluid not readily consumed by heat of the die. Primarily for aluminum and magnesium, but generally effective as a standard lubricant for all casting work.

Action: Always used sparingly, does not burn off readily, and is a general purpose lubricant.

• • •

Type PS: For plunger lubrication.

Character: Adherent, viscous grease especially compounded for plungers. Will not melt under highest casting temperatures. Although normally silvery in color, one grade car-

[1] **These lubricants are proprietary compounds developed and manufactured by G. W. Smith & Sons, Inc. They comprise the Die Slick series of die lubricants and Plunger Slick, which is a specific plunger lubricant. Die Slick lubricants referred to include types number 3, 4, 9, 11 and SG.**

Let
ADVANCE
tailor that complex die cast part to your assembly pattern
The specialized experience of ADVANCE engineers in aluminum and zinc die casting is called on almost every day for tailoring complex parts to fit certain assembly patterns. Their knowledge of problems in meeting special requirements pays off in all-around better tailored parts.
Why not take advantage of this specialized ability of ADVANCE engineers — write for our folder on ADVANCE Die Casting Service.
ADVANCE operates under the CERTIFIED ZINC PLAN of the American Die Casting Institute.
ADVANCE TOOL AND DIE CASTING CO.
3760 N. Holton St., Milwaukee 12, Wisconsin
Phone — WOodruff 4-0284
32 Years of Service to Industry
For additional information Circle No. 56 on the Reader Service Card

ries added micronized graphite for greater lubricity.

Action: Forms a film on sliding parts that will not break down under heat or friction. Smoothes cold chamber machine operation, prevents scoring, sticking, or wear.

All of these compounds can be reduced in concentration by the addition of mineral spirits or kerosene.

How many different lubricants are needed?

The average die casting shop will seldom require more than three (classified by alloys being cast) different die lubricants.

(1) Zinc castings (plated or unplated), or lead castings.

(2) Aluminum, magnesium, or unplated zinc castings.

(3) Brass castings.

The need to use more than one lubricant on the same die for the same alloy is uneconomical and generally an indication that the die lubricant is being called upon to help counteract the effects of insufficient draft, improper gating, venting, or other design fault. Good die lubricants can aid in many such cases; however they are never a substitute for proper die design.

For shops using cold chamber machines, a fourth compound should be added to the list, and that is a good plunger lubricant.

With this type of equipment, the molten casting alloy is ladled through a well or hole in the top of a chamber or cylinder. The plunger then moves forward through the cylinder forcing the liquid metal under great pressure into the die. The plunger must fit snugly in its pressure chamber to keep the casting alloy from by-passing. When this occurs, much of the applied pressure is lost and the solidified metal trapped between

continued next page

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IPM

POWDER METAL WASHER and SEAT

WASHER 1½¢

WASHER SEAT 2¢

. . . are precision formed to eliminate machining . . . simplify assembly . . . cut unit cost

IPM non-oxidizing powder copper parts used in gasoline pump valves are production controlled for high tensile strength, hardness and corrosion resistances. Die formed to extremely close tolerances these parts are assembled and staked to a stamping to guarantee leak-proof performance. It will pay you to investigate the many cost-saving advantages that IPM powder metal parts may have for your product. Our engineers are always available for consultation. Call today.

Engineers fact-filled handbook is yours for the asking. Write request on your company's letterhead.

IPM

International Powder Metallurgy Co.

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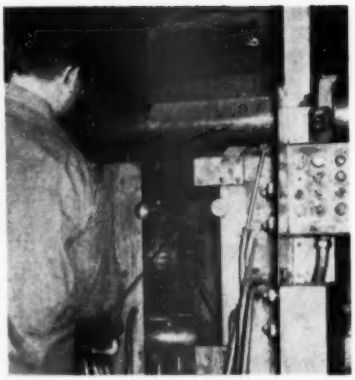
the plunger and its cylinder wall causing the plunger to stick. Adequate lubrication, therefore, is vital.

The lubricant film must have virtually unlimited resistance to heat and friction since it must also protect plunger and cylinder walls from attack by the molten casting alloy.

Proper lubricant application is important

It is almost impossible to stress enough the importance of the proper application of die casting lubricants. High quality, specialized lubricants do not have to be "sloshed" on thick to be effective. In fact, too heavy a coating often causes as much trouble as no lubricant at all.

The cardinal principle is to use the best lubricant, and to use no more than absolutely necessary. Excessive lubrication usually lets gases be entrapped rather than vented from the die, leads to porosity, stained castings, cold shuts, surface swirls and marring of the surface finish.

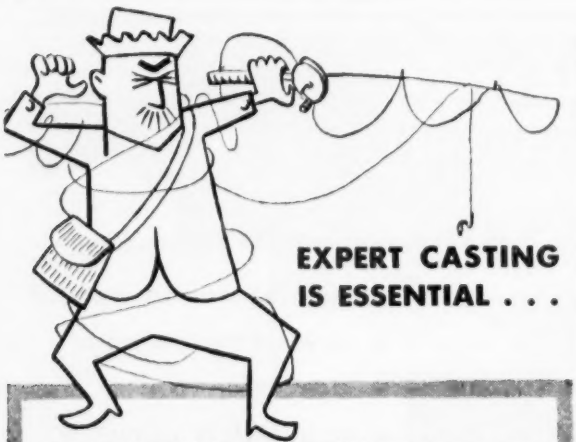


EJECTOR PINS get a spray of die lubricant.

Copious lubrication is advised when a new die is being tried out, with lubrication after each shot recommended until the die is worked in. Lubrication should then be reduced to a minimum commensurate with the alloy being cast and the complexity of the dies.

Brushes or swabs are far from ideal means of applying lubricants, not only because they apply a wastefully heavy coating, but because they do not permit application of a smooth, and even lubricating film. Most spray guns raise similar objections, with the added one that they are normally more awkward to handle.

It is our belief that a simple blow-pipe, consisting of a convenient length of 3/8" copper tubing attached to a pushbutton valve, and with the open end bent at a slight angle, makes the simplest and most effective die lubricant applicator. When dipped into the die lubricant, the lubricant clings to the tube and is quickly atomized by the air blast. A



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follow-up blast of air enables the operator to disperse the lubricant thoroughly, and to blow any excess out of the die cavities.

A brush does serve well to apply the viscous plunger lubricant to cold chamber machines. The practice of pouring a small amount of plunger lubricant in front of the plunger, however, is bad, for the plunger then can force the lubricant into the die ahead of the molten casting alloy causing stained castings and perhaps entrapment of the excess gases upon combustion of the lubricant.

Homemade vs. proprietary lubricants

Though in some ways die casting is still an art with many variables and consequently there will be many different opinions on this topic, by and large homemade lubricants seldom do the job as well. They cost more, if not in basic ingredients, then in inferior lubrication value, shortened die life, and a higher percentage of defective castings.

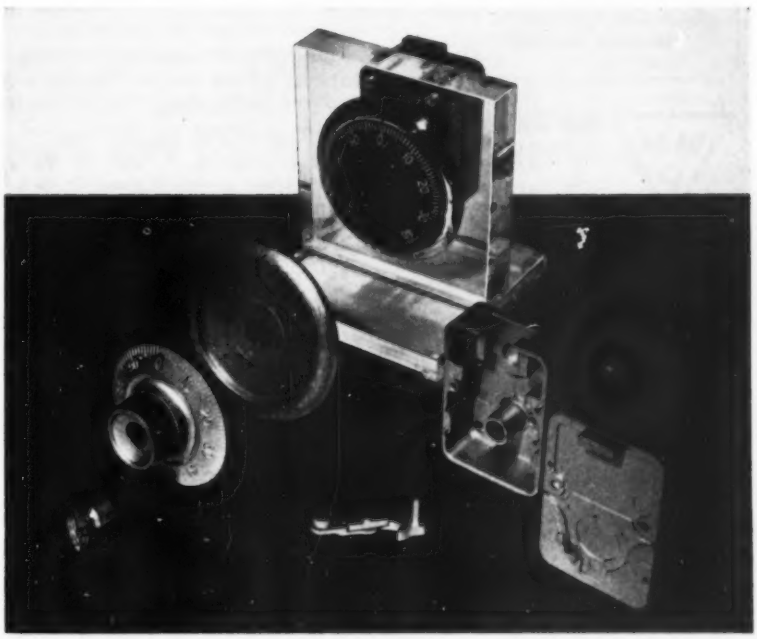
Those firms who, like us, specialize in die casting die lubricants, bring to their products the advantages of higher purity of ingredients, wider accumulated experience in die casting lubrication problems, and standardized compounds through rigid product control. And for the protection of their own business — a guarantee that no harmful ingredients are included.

We have found "Homemade mixes" which include such things as lard oil, palm oil, cocoa butter, stearic acid, beeswax, carnauba wax, tallow, potassium bromide, oil-graphite mixtures, oil-iodine mixtures, molybdenum sulphide, and various mineral oils, greases and other materials. Although these materials might serve on some jobs, in every case they have disadvantages which make them less than ideal die lubricants.

For example, bromides will corrode both dies and castings. Iodine is destructive to expensive steel dies. Animal and vegetable oils tend to rapid oxidation at elevated temperatures, and leave carbon and gum residues. Graphite (used in some of our compounds where stained castings are not objectionable) and molybdenum sulphide though good high-temperature lubricants, but, in our opinion, make for discolored castings, and more carbon or gummy residues with the attendant need for more frequent die cleaning. Mineral oils must be very pure, and include inhibitors before they are really acceptable as die lubricants.

continued next page

IT TAKES THE RIGHT COMBINATION



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DIE LUBRICATION — cont.

Frequency of application an individual problem

Here the good judgment of the operator must hold sway. He must balance the casting alloy properties against size and complexity of the casting, condition of the die, amount of draft allowed for ejection and the volume of metal being cast per cycle.

Generally speaking, our die lubricants are compounded for use in casting specific classes of alloys, and so they may be used on all parts of the die including cavities, cores, slides, and ejector mechanisms. As an average, anywhere from ten to fifty casting cycles can be made between lubricant applications in producing the average zinc casting; with the higher melting point alloys a good lubricant is usually applied after every three to ten cycles for average castings.

To sum up, even the finest die lubricants are not a panacea for impossible dies, but given good dies, and intelligent application, good lubricants will increase die life, generally improve production rates, cut rejects, and often make it profitable to turn out castings that would be virtually impossible to produce otherwise.

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SINTERING PROCESS
continued from page 59

reason known relationships can only be used in a qualitative manner.

In discussing solid diffusion it must be recognized that at least three types exist and may operate simultaneously:

Volume diffusion in which the atoms of the solute diffuse through the solvent without reference to grain boundaries or other crystallographic differences. This is the slowest type of diffusion, but the only one that is capable of producing a homogeneous system or one at equilibrium.

Grain boundary diffusion in which the atomic migration is along the grain boundaries. This type of diffusion is more rapid than volume diffusion at the same temperature because the path of diffusion is simpler.

Surface diffusion where the atoms move along the surface of the grains in an attempt to fill voids between the grains. This is the most rapid type of diffusion.

The relative rates of diffusion are shown graphically in Figure 3.

In powder metallurgy only two types of diffusion are concerned, primarily: surface diffusion and volume diffusion. Both types are involved in the sintering process.

Surface diffusion: Green compacts are made up of particles that make contact with one another at points or, at most, over small areas. There remain cavities of a shape that can be approximately reproduced by bringing together the tips of the thumbs and two fingers. This approximately triangular space shrinks during sintering, first by the contraction of the corners to make the cavity nearly spherical, and then by the contraction of the spherical cavity to zero volume.

continued next page

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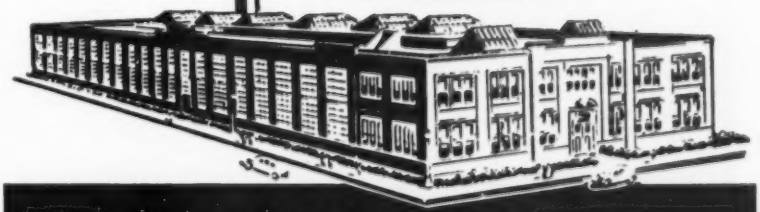

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SINTERING — cont.

The mechanism of this (the spherodization of the cavity) involves self-diffusion and surface diffusion at the same time. The driving force is the surface tension within the cavity. The surface tension is extremely high at the corners of the triangular cavity, where the curvature of the surface is at a maximum. Atoms are caused to move along the surface of the metal within the cavity toward the corners, thus filling them and producing a rounded contour. This is a rapid action because it depends upon surface diffusion, and since it involves the atoms of the solvent chiefly, it is also self-diffusion.

When the hole is spherical there still remains some surface tension as a driving force to cause atoms to move from the body of the metal toward the interior of the cavity. Unless this force is resisted by gases or other material present in the cavity, the hole will disappear in time. The rate of its shrinkage increases as the hole becomes smaller, because the surface tension becomes higher as the circumference of the hole becomes more sharply curved. Therefore, it is uncommon to find many small holes in a sintered object; we see chiefly larger cavities approaching the size of the original pore.

Volume diffusion (intermetallic diffusion)

While the process of surface diffusion and the closing of the interparticle voids is going on, the solute atoms are also diffusing through the solvent grains. The amount of alloying will depend upon both temperature and time and, as has been pointed out, the rate will decrease with time but will increase exponentially with the absolute temperature.

The process can best be il-

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lustrated by two typical cases of diffusion, in both cases it will be assumed that there is no liquid phase present.

In the first case consider a mixture of copper and zinc powders of a composition to form commercial red brass (10% zinc, 90% copper). This composition is represented by the dotted line a-b in Figure 4. The structure immediately after diffusion has begun may be predicted by drawing across the phase diagram a horizontal line at the temperature of the heat treatment. Between adjacent grains of the two pure metals layers will form corresponding in kind and in order to the one phase region crossed by the line. No two phase layers will form isothermally. If such appear in the structure, they have been produced as a result of phase changes occuring on heating and cooling.

For example in the 90-10 powder mixture, we will find at first, structures composed of the alpha rich copper phase and between them successive layers of beta, gamma, and epsilon. After a time, all of the zinc rich layers will have increased in thickness. Now the eta phase begins to be absorbed with a growth in the thickness of the beta and gamma layers. When the eta has disappeared, the thickness of the gamma layer will begin to decline, and this process continues until everything has disappeared except the alpha phase, which then gradually approaches a homogeneous composition of 10 percent zinc.

The physical properties naturally vary in accordance with these structural changes. In the end, the properties are those of a normal commercial red brass, but at intermediate times abnormally high hardness and low elongation may be found owing to the presence of relatively large quantities of the brittle gamma and epsilon phases.

continued next page

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When no intermediate phases form, the process of homogenization begins at once, for example, the copper-nickel system see Figure 5. Here, copper diffuses into the nickel and nickel into the copper until a uniform distribution is achieved. The speed of progress toward the homogeneous state is dependent upon the distance between centers which in turn is dependent upon the powder particle size and the composition of the mixture. If the distance between unlike centers is doubled, the time to reach an equivalent degree of homogeniety will be squared.

Here again, the intermetallic properties may be widely different from those at the beginning and end of diffusion. For example, the hardness of the copper-nickel series shows a maximum at the 50-50 composition. If a mixture of copper and nickel is made in the ratio of 70-30 and its hardness as a function of sintering is measured a maximum in the hardness curve occurs before the homogeneous state is reached because midway in the diffusion process much of the alloy of the 50-50 composition is present in the mixture. Later this disappears as the composition 70-30 is approached, and the hardness drops to that of the normal alloy. This change in hardness is illustrated in Figure 6.

For those cases where more than two metallic components are present it is possible to follow the course of the sintering cycle in much the same manner as for a binary alloy, but for present purposes it is not necessary to do so. It is also possible to predict the progress of sintering in those cases where a liquid phase is present, but again such a discussion would be largely repetitive of what has gone before with only minor changes.

TABLE 1

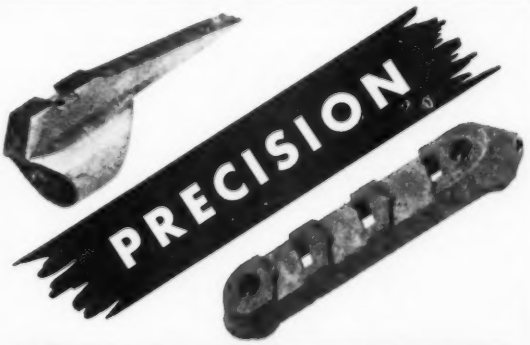
E	Atomic Vol.	Fe/E	Crystal Structure	Lat. Const.	E	Atomic Vol.	Fe/E	Crystal Structure	Lat. Const.
K	45.5	.156	cubic		Cb	11.1	.639	Rhomb.	
Ba	36.6	.194			Ta	10.9	.650	Body cent. cubic	3.27
Sr	33.7	.210	cubic		Ti	10.7	.663	Hex. close packed	2.97
Ca	26.0	.273	Face cent. cubic	5.56	Ag	10.2	.696	Face cent. cubic	4.06
Na	23.7	.299	cubic		Au	10.2	.696	Face cent. cubic	4.08
La	22.6	.314			Al	10.0	.710	Face cent. cubic	4.05
Bi	21.4	.331	Rhombohedral hex.	4.54	W	9.5	.746	Body cent. cubic	3.15
Nd	20.9	.339			Mo	9.3	.763	Body cent. cubic	3.14
Ce	20.6	.344	Hex. close packed	3.65	Zn	9.1	.780	Hex. close packed	2.67
			Face cent. cubic	5.12	Pt	9.1	.780	Face cent. cubic	3.93
Te	20.4	.348	Rhomb.		Pd	8.8	.807	Face cent. cubic	3.95
Sm	19.5	.364	cubic		Ir	8.6	.825	Face cent. cubic	3.805
Th	19.1	.371	Face cent. cubic	5.04	Os	8.5	.836	Hex. close packed	2.714
Pb	18.3	.388	Face cent. cubic	4.92	V	8.5	.836	Body cent. cubic	3.04
Sc	18.1	.392			Ru	8.4	.845	Hex. close packed	2.686
Sb	18.0	.394	Rhom. hex.	4.28	Rh	8.3	.873	Face cent. cubic	3.82
P	17.0	.418	Face cent. cubic	3.90	Cr	7.5	.946	Body cent. cubic	2.89
Se	17.0	.418			Mn	7.4	.960	Cubic or tetrag.	
Sn	16.3	.435	Hex. close packed	2.97	Cu	7.15	.993	Face cent. cubic	3.6
S	16.0	.443	Rhomb.		Fe	7.1	1.000	Face cent. cubic	3.6
In	15.8	.449	Face cent. tet.	4.58				Body cent. cubic	2.86
Hg	14.7	.483			Co	6.8	1.044	Face cent. cubic	3.55
Zr	14.1	.503	Hex. close packed	3.23				Hex. close packed	2.51
Mg	14.0	.507	Hexagonal	3.22	Ni	6.7	1.058	Face cent. cubic	3.54
As	13.1	.542	Hexagonal		B	5.4	1.315		
Cd	13.0	.546	Hex. close packed	2.96	C graph	5.37	1.322	Tetrahedral cubic	3.56
Li	13.0	.546	Body cent. cubic	3.50	Be	4.9	1.449	Hexagonal	
U	12.7	.559	cubic		C dia.	3.42	2.076	Hexagonal	2.47
Si	11.6	.612	cubic						

It has been shown how the basic principles of solid diffusion apply to powder metallurgy (and also massive metal) in a qualitative manner, as well as some of the factors that must be considered. The characteristics that are peculiar to powder metallurgy in the application of solid diffusion data will now be examined.

Primary factors

The factors of primary importance are:

1. The solid solubility of the solute in the solvent,



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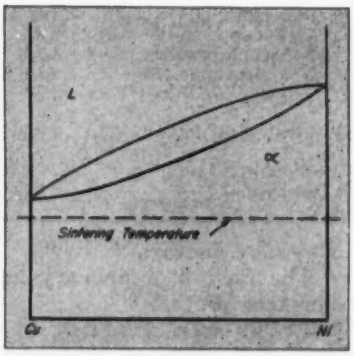
SINTERING — cont.

2. The relative size of the solvent and solute particles,
3. The chemical similarity of the metals,
4. The ratio of the atomic volume of the solvent to the atomic volume of the solute,
5. The difference in melting point of solvent and solute metals,



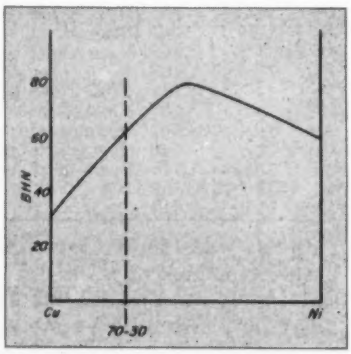
Regarding the *solid solubility*, it has been pointed out that in order to have alloying in any system as high a degree of solid solubility as is possible is required. This is particularly true when a substitutional type of alloy is to be made. Therefore, for maximum alloying by solid diffusion, the solid solubility of one metal in the others should be as high as possible.

The *particle size* enters into solid diffusion in that, from the diffusion equation, it is clear that the rate varies as the square of the path across which metal must be moved. Therefore, for rapid diffusion the particle sizes should be as small as possible. In practice, it is found that it is desirable to have the solvent particles relatively large, and the solute particles small. This relationship is purely empircal and may not seem to make sense, but has been experimentally proven.

The need for *chemical similarity* is, of course, quite obvious.

The *ratio of atomic volumes* should be as small as possible. This comes from the fact that much of the solid diffusion that takes place is substitutional, so that the distortion of the crystal lattice is less when a small solute atom enters into the lattice.

6. The crystal structure of the metals.



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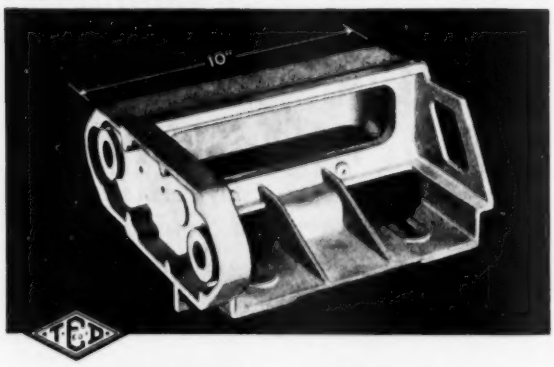

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The *difference in melting points* for rapid solid diffusion should be as large as possible. This, again, is a purely empirical point. The probable reason for this is that activation energy becomes high as the melting point is approached, and it is necessary to secure a desirable ratio of activation energies.

The *similarity of crystal structures* is an obvious necessity where either substitutional or interstitial solid diffusion occurs.

Some of the less readily available data that is useful in predicting the probable course of alloying during sintering is given in Table I. Neither melting points nor activation energy values (Q) are listed. Melting points are generally well known and data for activation energies is so scattered, at present, that a good compilation is not possible.

"Part Two — Furnaces," will be presented by PMM in November.

FEDERATED OPENS NEW RESEARCH FOUNDRY

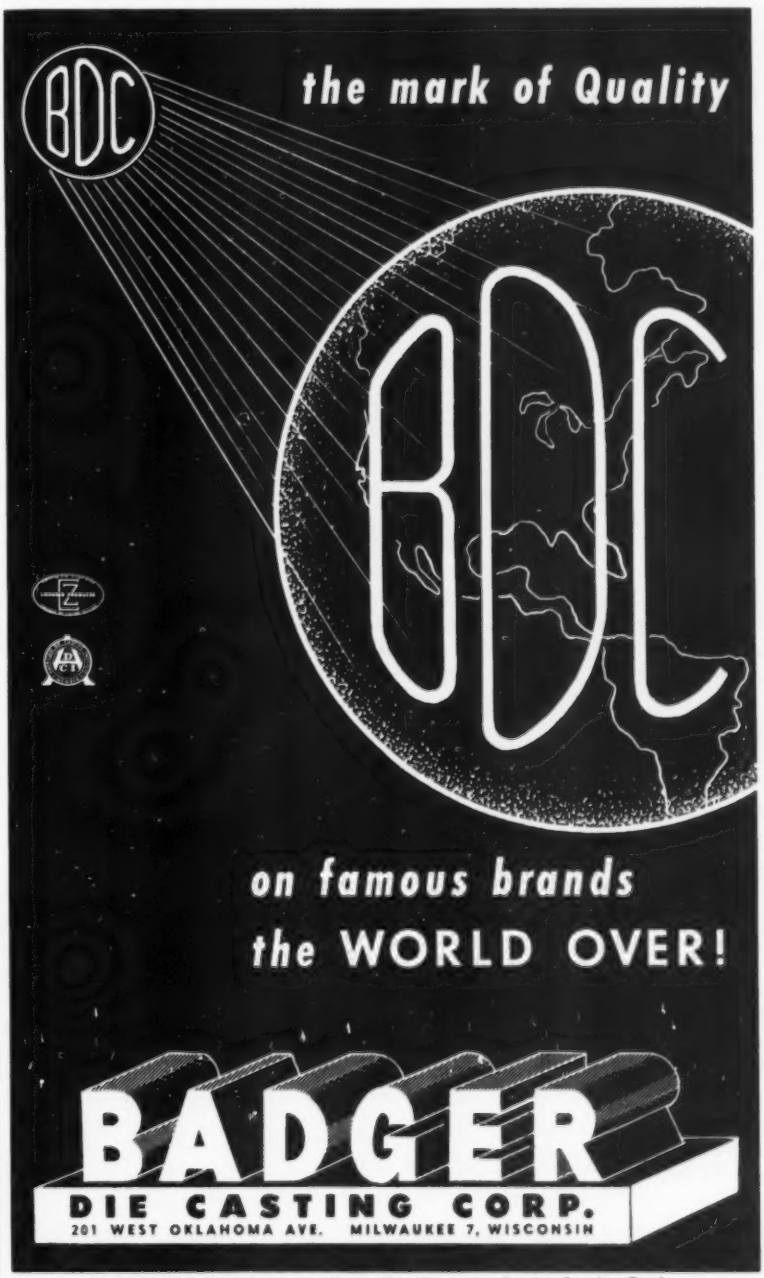
R. D. Taylor, assistant to the vice president in charge of development, and Donald L. La Velle, metallurgist in charge of foundry research, pour the first casting made in the new Federated Metals Division research foundry at South Plainfield, N. J., shown below.

Federated is a division of American Smelting and Refining Company.

CAST TITANIUM SHAPES PRODUCED BY NRC

Richard S. Morse, President of National Research Corporation has announced the development of a method for the production of cast shapes of titanium metal. This accomplishment is the result of an intensive program aimed at the development of special vacuum melting furnaces, casting procedures and mold materials capable of withstanding attack by molten titanium.

The development was sponsored by National Research Corporation in accordance with Department of Defense policies which encourage private industry to employ its own funds to develop techniques and products to a point where the military can procure material on a purchase order basis.



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GROWING USES FOR METAL POWDER REPORTED AT MPA MEETINGS

MEETING HIGHLIGHTS

An expanding field of uses for powdered metal parts was outlined at the first Fall meeting of the Metal Powder Association, held during Septembber. A series of speakers who reported on trends in various specific fields of activity gave a well-rounded picture concerning present and future uses that will be served by the powder metallurgy industry. About 100 members of the MPA attended the closed sessions at White Sulphur Springs Sept. 11-12. They heard keynote speaker, the Hon Felix E. Wormser, assistant Secretary of the Interior and attended panel sessions on iron powder, non-ferrous powder, and specialized subjects.

STEEL POWDER

Robert Talmage, consulting powder metallurgist, predicted that the price of steel powder will soon be less than that of finished steel and may approach that of pig iron. "Cost per pound of production decreases as the size of the plant increases." He pointed out that today's production plants are still extremely small compared to those for steel, and that new ways are being found to produce good powder directly from ore.

SUBSTITUTION

Small iron castings, when required in limited quantities, can be very expensive, but in many cases, such parts are being economically and satisfactorily replaced by metal powder parts, according to a report by T. L. Robinson, president of Powdercraft Corp., who indicated many typical examples from the textile machinery industry as evidence. Mr. Robinson provided detailed comparative analyses of specific examples.

HOME APPLIANCES

Bushings, gears and structural iron parts are being specified as metal powder parts in the design of washing machines and other household appliances on an increasing scale, according to W. A. Irvine of the Maytag Co. Economy and precision, along with such unique properties as self-lubrication, were said to be the reasons.

FRICTION MATERIAL

The advent of automatic transmissions and more powerful engines have made it essential to use clutch and brake materials made from metallic powders, the members were told by Clyde Batchelor of Raybestos Manhattan Corp. It should represent an expanding market for metal powders, he said.

MILITARY USES

"The sintered iron shell rotating band development program is continuing," according to John D. Dale representing Frankford Arsenal, "with responsibility for different phases of the program carefully assigned to Watertown, Picatinny and Frankford Arsenals.

"Along with the improved quality and performance of iron powders and parts made from them, revisions to existing specification (Mil-R-110-73A) are being considered carefully." Mr. Dale reported that since the last review of this topic more than 2,000,000 artillery shells have been furnished with sintered iron bands for issue to troops in the field. "It will be some time before all the reports are in concerning their performance, accuracy and their effect on the life of the weapon," he said. "After some early disappointments, which we might expect in any new development, there has been not a single lot reported to be rejected from any production lots at the proving grounds.

"The 105 MM shell band has been redesigned down to and including production tools and production method. The first large scale firing test of the new design is scheduled to start this month. When the results are known and analyzed the Chief of Ordnance will decide to what extent sintered bands can be applied to that round. Excellent progress is being made and useful data should be at hand before the end of the year.

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SILVER ANNIVERSARY
continued from page 53

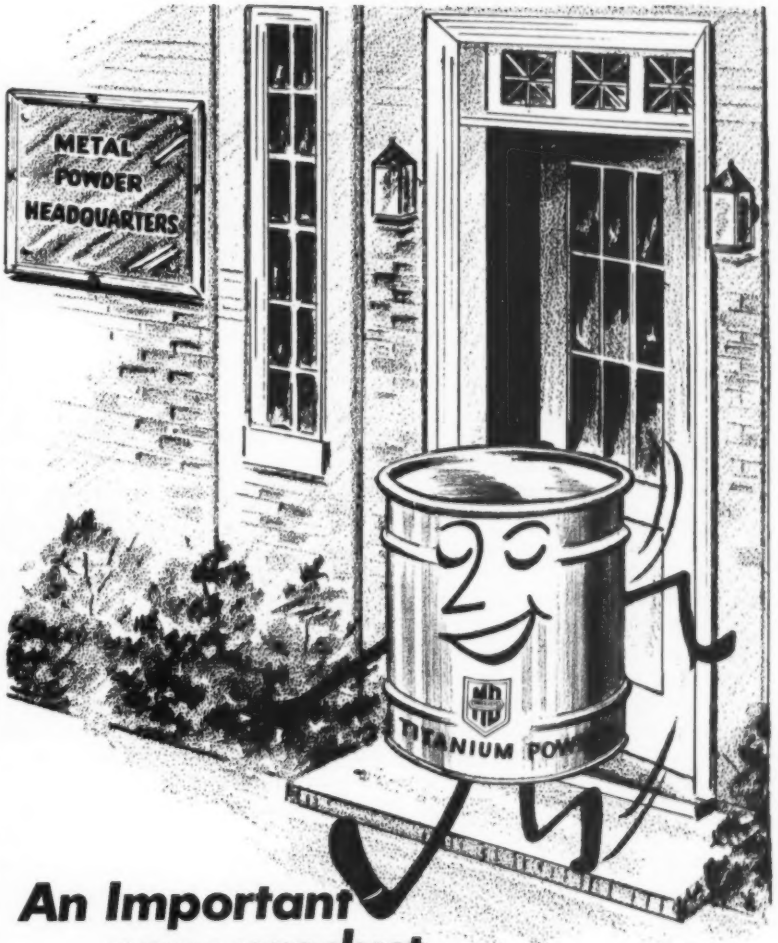
casting, either as a preferred method or an alternate, totaled over one thousand."

"Density considerations," he indicated, "compelled the use of aluminum for 80 percent of them, but zinc die castings gave an excellent account of themselves in instances where they were specified."

Regarding future uses for die cast materials in ammunition, Gen. Davis gave the opinion that aluminum alloys will continue to account for the lion's share of die cast ammunition pieces. "The same considerations and ballistic facts which caused preponderance of aluminum castings in World War II prevail today," he said.

However, he suggested that a greater percentage of zinc die castings must have been used in the Korean War than in World War II due to the greater use of grenades. He also criticized failure to use more zinc die castings in ammunition because of problems connected with low-temperature service. "I am one of those who continue to believe we should have on the shelf some specialized designs suitable for Arctic operations, rather than prejudice the cost and efficiency of the vastly greater ammunition tonnage that will never be used in the Arctic," Gen Davis said.

The speaker recommended that much work could be done on present drawings and specifications for die cast ammuniton parts, both on dimensional tolerances and porosity standards to make them attainable and yet adequate for function. He suggested that the American Die Casting Institute would be the best qualified to work with military agencies on this project.



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TOO HARD TO MACHINE . . .

magnetic materials can be made from metal powder

BY C. F. BROETZMAN*

MAGNETIC pulleys and magnetic separators find application wherever it is desirable or essential to remove magnetic materials from a mixture, whether the magnetic material be the product desired or a contaminant.

In the design of these magnetic devices permanent magnets play an important part. With the advent of the Alnico type of magnet it became possible to create a much higher magnetic field with a much smaller unit; smaller, that is, in both weight and volume. A marked disadvantage of this type of material, however, is its hardness so that shaping by any method other than grinding was impossible.

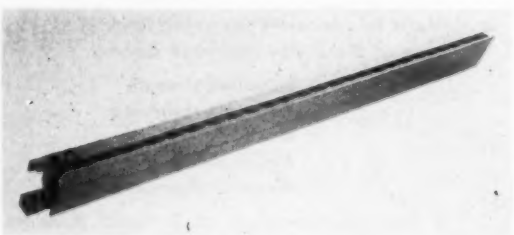
Only a few years ago, about 1938, sintered Alnico magnets were developed so that shapes which previously could not be achieved became a possibility. This put in the hands of the design engineer what was, essentially, a new material and one made possible only by the development of powder metallurgy.

Because each application of a magnetic separator is a tailored job it is essential that factors other than the physical size and shape of the magnet be variable. Where, for example the problem is removal of tramp iron and where the material passing over the separator is in a thin bed; it is possible to utilize magnets which may have a relatively low field strength.

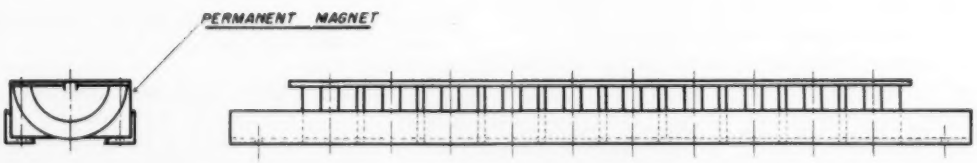
In other cases where a rather thick bed of material passes over the magnet and where much smaller iron particles must be retained it becomes necessary to use magnets of higher field strength and in some cases smaller size.

*Chief Engineer, Stearns Magnetic, Inc.

Where powdered metal magnets are used . . .



FLAT PLATE TYPE of magnetic separator. Discharge of magnetic material from this separator is periodic by retracting the magnets to decrease the field strength.



The desired changes can be secured by changing the composition of the magnetic material.

If the magnets were made by conventional melting and casting procedures or were a steel mill product it would be necessary to make rather large batches of each particular composition. For special applications this would run the cost of a separator much too high to be saleable.

With powder metallurgy, on the other hand, it is a relatively simple matter to make very wide variations in compositon without having to make more than just enough for the job at hand. Thus the costs for special materials can be held to a minimum.

Normally, of course, standard stock magnets are used and the ability of powder metallurgy to make these magnets in the desired shape with mounting holes, lugs, bosses, etc. where needed again materially lowers the final cost of a separator.

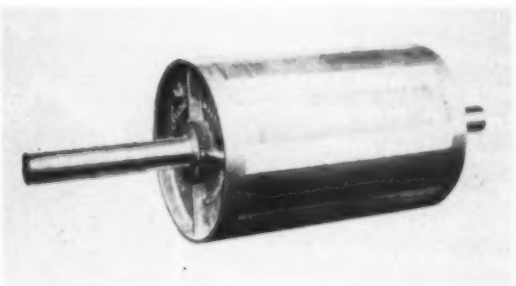
Thus it is seen that some of the peculiar abilities of powder metallurgy have made it possible to tailor the separator to the job better than has ever been done before and at a price that allows industry to utilize these separators more widely than would be possible otherwise.

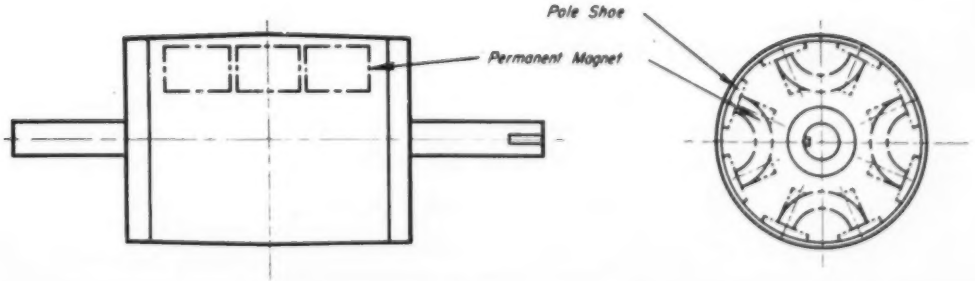
The attached illustrations show how several types of separators work. Whether the magnets are fixed and a drum revolves around them or whether the magnets revolve with a drum and the material is handled on a belt. all of them depend upon a gravity discharge of the non-magnetic material when the angle of inclination becomes greater than the angle of repose. The magnetic material, on the other hand is held in the field until the field strength decreases sufficiently so that the iron is discharged due to the weight of the particles.

Since the field strength varies inversely as the square of the distance, the point of discharge can be accurately determined by providing the proper air gap at the position where discharge is desired. Naturally the mass of the iron particles will also determine the position of discharge so that the area over which the iron is released must be great enough to accomodate pieces of all size that are liable to be in the mixture being handled.

One other type of separator is illustrated, that is the plate type. Here, the magnetic material is retained over the pole pieces while the non-magnetic material passes on. Periodically the magnets are retracted so that the iron can be discharged. This type, while different in design and operation is essentially the same as a drum type of separator in that a strong magnetic field is retained until discharge is desired and then the field is weakened by increasing the air gap between the pole pieces of the magnets and the magnetic material.

DRUM TYPE of magnetic separator for use with a belt conveyor. Iron is held on the belt until the air gap becomes sufficiently great to lower the field strength so that the metal is discharged.





THE TOY INDUSTRY
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the job (this is a safe assumption) then tremendous numbers of parts can be made with the same inherent accuracy as that built into the die.

It is common practice when cemented carbide dies are used to produce several million pieces before measurable wear occurs which might throw any dimension outside of the allowable manufacturing tolerances.

Lowered tooling costs

From what has been said above, it is fairly obvious that powder metallurgy can show major savings in tooling. Not only will a set of tools for powder molding be lower in cost in many cases than a comparable set of tools for blanking and piercing, but in many cases one set of tools for powder metallurgy will make a part that, by any other method, would require two, three or more sets of tools.

When cemented carbide dies are used the die block will seldom wear out during the life of any one design. Punches, unfortunately, can not be made of carbide at the present time and must be of tool steel. Wear on the punches is, of course, considerably greater than on the die and it is normal practice to dress the upper punches after about 250,000 pieces have been made and the lower punches after making about 750,000 pieces.

Contrast this tool life with a normal blanking die. Two complete sets of tools are generally needed so that one set can be in use while the others are being redressed. This is not an unusual condition.

Another major tooling saving that is accomplished through the use of powder metallurgy is either the elimination of many jigs and fixtures for second operations, or the simplification of these. The inherent accuracy of a powder metal part will, in many cases, allow the simplest type of holding device to be used as contrasted with a jig that must have the desired accuracy of positioning built into it.

From what has been said above the reasons for the use of powder metallurgy as a manufacturing method by the A. C. Gilbert Co. are obvious. Emphasis should again be placed on the fact that while everything that has been said is based on experience in the manufacture of toys, it applies with equal force to any other manufacturing operation where somewhat comparable conditions exist.

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HOUGHTON TO EXPAND RESEARCH FACILITIES TO STUDY 4 FIELDS

Plans for an expanded research program, including a further addition to its laboratories, have been approved by the Board of Directors of E. F. Houghton & Co., manufacturers of oils, chemicals and hydraulic leathers, 303 W. Lehigh Ave., Philadelphia.

An additional floor will be added over the present research laboratory to provide required facilities for the program, and the staff of chemists will be increased. This expansion is particularly aimed at four fields, all of which represent areas of interest consistently covered by this company in past years.

1. A new approach to the project of cutting fluids for modern machine tools, following up recent Houghton developments. There is an ever increasing responsibility on the cutting fluid, it is pointed out, due to higher machine speeds, new alloys such as nimonic and titanium, and new developments in tooling.

2. Further study of chemical surface treatment of metals, including new developments in phosphating compounds, pickling inhibitors and coloring agents.

3. An expanded heat treatment program, including new furnaces and research on new types of molten salt baths for treating steel and non-ferrous metals.

4. Added emphasis on textile oils and synthetic processing agents for the many new man-made fibers now being perfected.

Construction will begin this Fall, with the hope of starting on this further research program early in 1954. Houghton's present laboratory was built in 1928 and an addition constructed in 1941.

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METAL POWDER USES
continued from page 116

Mr. Dale detailed possible applications of powder metallurgy in electronic fuses and mechanical time fuses. "At current production schedules and at current prices there is a saving of five million dollars on parts in the M-501 mechanical time fuse made from metal powders and there will be an additional estimated saving of at least four million dollars per year when five additional metal powder components are accepted", he said.

"The M 21A4 Booster Rotor passed the hundred million mark sometime ago", said Mr. Dale, who estimated monetary savings of at least ten million dollars on this single item.

IRON CORES

Six reasons for the continuing extensive use of iron powder cores in the electronic industry were given by Henry L. Crowley Company, including:

(1) Greater efficiency through increased gain with lower losses.

(2) Conservation of critical and restricted materials, notably in **aluminum** by eliminating variable condensers, and again by minimizing the need for shield cans, since coils can be magnetically shielded through their own core elements; **in copper,** by increasing the efficency of wire windings; **in powder-iron and associated ingredients,** by developing other materials that can substitute for, or at least extend the use of critical or restricted materials.

(3) Marked reduction in size and weight of electronic assemblies, due to the higher working efficiency of iron core coils.

(4) Cutting down the required number of tubes, by obtaining higher efficiency out of given circuits.

(5) Cost reduction, through simplified circuits and less components and tubes.

(6) Easier and sharper tuning when using the permeability tuner, especially the push-button and manual tuner version.

Further reviewing the electronic core industry, T. L. Moore, General Dyestuff Corp., New York City, discussed the powder supply picture for electronic cores. "The published optimism of the producers of radio, TV and other electronic equipment is shared by and is influencing the planning of the iron powder producer members of the Metal Powder Association," he said.

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PRUNING SHEARS
continued from page 61

In addition to the factor of strength, there are other factors that make aluminum die castings the most desirable material of construction for this product; weight is one. By using aluminum as the main structural material the total weight of the shear has been reduced by about two-thirds. Not only does this reduce operator fatigue when the shears are used for extended periods of time, but means less to carry around when only an occasional pruning job is to be done. This latter factor is particularly important when the shear is used by women. Their light weight combined with their streamlined, rounded shape, makes them ideal to carry around in the pocket.

In a forged steel shear the cutting blade must be rather thick when forged and can be made thin enough to do a good cutting job only by grinding. Using an aluminum frame the steel cutting blade can be made as thin as desired with far less finish grinding. Further the blade can be replaced when worn or damaged instead of having to replace the entire tool.

The anvil against which the cutting blade works must, in the case of an all steel tool, be of some softer material, usually brass. This means extra manufacturing and extra assembly operations.

With die cast construction the member carrying the steel blade is used as received from the foundry except to drill a small hole to take a pivot pin holding the locking device in place. On the other member a groove is cut in the anvil face to match the cutting edge of the blade. These are the only machine operations necessary. Quite obviously, there is a very

continued next page

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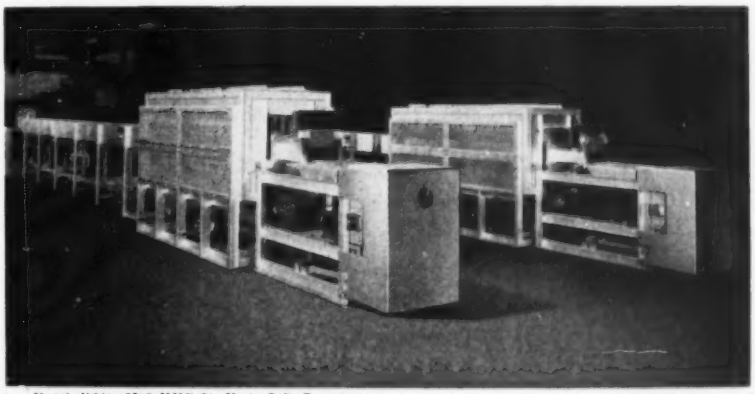

Model HOU-12516-MMB-21 Mesh Belt Furnaces, Maximum Temperature 2100F.

Another Fabricator Buys

Harper

Shown above are two Harper Electric Conntinuous Mesh Belt Furnaces recently installed in the plant of a well-known fabricator of powdered metal products.

For detailed information on special and standard high producing Harper Electric Mesh Belt Furnaces, write to Department 15. Or, if attending the Metal Show, VISIT HARPER BOOTH NO 647, METAL SHOW, CLEVELAND, OCT. 19-23, 1953.

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PRUNING SHEARS — cont.

material saving in manufacturing cost due to the reduced machining.

On surface finishing another important manufacturing cost saving is realized. As the die castings are received from the foundry they are ready for finishing except for sand blasting. Following sand blasting the parts are coated with clear lacquer and the handles dipped in maroon enamel. The enamel is then baked to give a more durable finish.

Again, when this finishing is compared with that required for either steel or brass there is a marked reduction in cost. Not only is over-all sanding and polishing avoided, but plating in some cases and over-all painting and lacquering is unnecessary.

Corrosion resistance is another advantage gained by the use of aluminum. Pruning shears are seldom given the care accorded to other edge tools. As a result, corrosion of exposed metal parts is commonplace. With aluminum this factor is completely eliminated and even under the most adverse conditions no noticeable corrosion will take place during the life of the shear.

In the eight years that these die cast aluminum pruning shears have been on the market it is interesting to note that practically the only failures that have been recorded are failures of the replaceable steel blade due to abuse.

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PROMOTIONS

continued from page 100

Announcement has been made of the promotion of FRANK WARGA to the new post of general foundry foreman of *AiResearch Mfg. Co.* He will be in charge of all foundry operations for the company; he was formerly foreman of the aluminum foundry.

Appointment of CLEM H. HOHNER as district manager of the *Udylite Corp.* southeastern sales district was announced recently.

JOHN V. MORAN, JR. has been appointed section head of the special publications section of the *International Nickel Co., Inc.*, succeeding the late Edward C. Badeau, it was announced by HERBERT G. FALES, vice president.

M. B. TERRY has been appointed president of *American Brakeblok Div.* of *American Brake Shoe Co.* He was formerly executive vice president of American Brakeblok.

RICHARD C. MARTIN has been promoted to the position of national sales director of *Kelite Products, Inc.*

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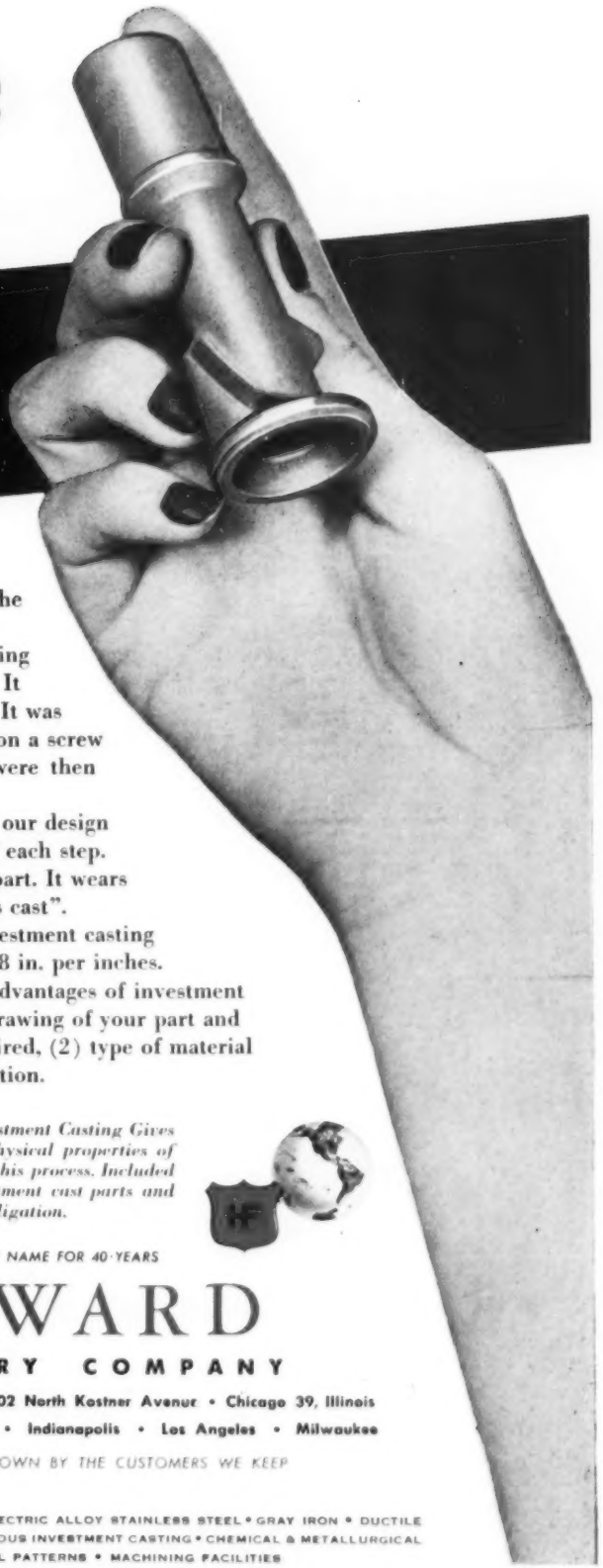

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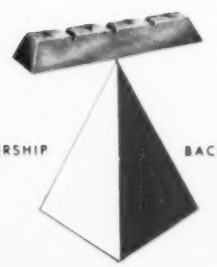

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